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Two novel closteroviruses, fig virus A and fig virus B, identified by the analysis of the high-throughput RNA-sequencing data of fig (*Ficus carica*) latex

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Summary. – Closteroviruses (the genus *Closterovirus*, the family *Closteroviridae*) are RNA viruses that infect and cause viral diseases in many economically important plants. Genome sequences of two novel closteroviruses named fig virus A (FiVA) and fig virus B (FiVB) were identified in high-throughput sequencing data obtained from a fig latex sample. FiVA and FiVB genomes, whose lengths are 19,333 bp and 18,741 bp, respectively, were predicted to have 14 shared open reading frames, nine of which had homologs in other closteroviruses. Phylogenetic analysis confirmed that FiVA and FiVB are novel closteroviruses forming a strong subclade with fig mild mottle-associated virus within the genus *Closterovirus*. FiVA and FiVB genome sequences identified in this study are useful resources for investigating the evolution of closterovirus genome organization.

Keywords: fig virus A; fig virus B; Closterovirus; common fig; Ficus carica

Introduction

Closteroviruses (the genus *Closterovirus*) are plant-infecting RNA viruses of the family *Closteroviridae*, which contain three other genera (*Ampelovirus*, *Crinivirus*, and *Velarivirus*) and some unassigned species (Agranovsky, 2016; Fuchs *et al.*, 2020). Members of the genus *Closterovirus*, whose type species is beet yellows virus (BYV), infect and cause viral diseases in many economically important plants (Karasev *et al.*, 1995; Koloniuk *et al.*, 2018; Orilio *et al.*, 2018; Zheng *et al.*, 2018).

Closteroviruses have long and flexuous virions with a large positive-sense single-stranded RNA genome of 14–19 kb. The genome encodes about 10 conserved open reading frames (ORFs), including polyprotein (ORF1a), RNA-dependent RNA polymerase (RdRp; ORF1b), 6-kDa protein (p6), heat shock protein 70 homolog (Hsp70h), heat shock protein 90 homolog (Hsp90h), minor coat protein (CPm), and major coat protein (CP) (Zheng *et al.*, 2018; Fuchs *et al.*, 2020). The polyprotein is proteolytically processed into papain-like protease, methyltransferase, and helicase. The RdRp is produced as a fusion ORF1ab by the +1 ribosomal frameshift at the end of ORF1. In addition, unique ORFs that are shared by some members are also observed (Karasev *et al.*, 1995; Tzanetakis *et al.*, 2007; He *et al.*, 2015; Agranovsky, 2016; Zheng *et al.*, 2018).

High-throughput RNA-sequencing data obtained from plant samples often contain sequences derived from novel RNA virus genomes, which can be identified by a comprehensive sequence analysis (Kim *et al.*, 2018; Koloniuk *et al.*, 2018; Orilio *et al.*, 2018; Park *et al.*, 2018; Zheng *et al.*, 2018). In this study, we analyzed high-throughput RNA-sequencing data acquired from a latex sample of the common fig (*Ficus carica*) and identified the genome sequences of two novel members of the genus *Closterovirus*.

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Abbreviations: CP = coat protein; CPm = minor coat protein; CTV = citrus tristeza virus; FiVA = fig virus A; FiVB = fig virus B; FMMaV = fig mild mottle-associated virus; Hsp70h = heat shock protein 70 homolog; Hsp90h = heat shock protein 90 homolog; NCBI = National Center for Biotechnology Information; ORF = open reading frame; p6 = 6-kDa protein; RdRp = RNA-dependent RNA polymerase; SRA = Sequence Read Archive

Table 1. ORFs of the FiVA and FiVB genome sequences

ORF	FiVA (aa)[a]	FiVB (aa)[a]	Gene	Protein	Identity[b]	Pfam domain[c]
ORF1a	2956	2688	Polyprotein	polyprotein 1a	1399/2977 (47.0%)	Beet yellows virus-type papain-like endopeptidase C42 (PF05533), viral methyltransferase (PF01660), viral (Superfamily 1) RNA helicase (PF01443)
ORF1b	538	529	RdRp	RNA-dependent RNA polymerase	371/539 (68.8%)	RNA dependent RNA polymerase (PF00978)
ORF2	102	103		hypothetical protein	29/103 (28.2%)	
ORF3	215	204		hypothetical protein	84/216 (38.9%)	
ORF4	61	60	p6	p6 protein	48/61 (78.7%)	Citrus tristeza virus 6-kDa protein (PF06706)
ORF5	594	591	Hsp70h	heat shock 70-like protein	334/595 (56.1%)	Hsp70 protein (PF00012)
ORF6	507	524	Hsp90h	heat shock 90-like protein	241/525 (45.9%)	Viral heat shock protein Hsp90 homologue (PF03225)
ORF7	232	230	CPm	minor coat protein	145/233 (62.2%)	Closterovirus coat protein (PF01785)
ORF8	236	248	CP	coat protein	145/248 (58.5%)	Closterovirus coat protein (PF01785)
ORF9	58	58		hypothetical protein	20/58 (34.5%)	
ORF10	77	77		hypothetical protein	43/79 (54.4%)	
ORF11	187	189		hypothetical protein	51/189 (27.0%)	
ORF12	247	230	p28/p26[d]	p28/p26 protein	102/252 (40.5%)	
ORF13	207	207	p23	RNA silencing suppressor	145/207 (70.0%)	RNA silencing suppressor P21 C-terminal domain (PF11479)

[a]Protein length; [b]Protein sequence identity between FiVA and FiVB orthologs in the format: "Identical residues/aligned length (% identity)"; [c]Pfam domain name and accession number; [d]ORF12 encodes a 28 (FiVA) or 26 (FiVB) kDa protein.

Materials and Methods

A high-throughput RNA-sequencing dataset (3.5 Gbp) obtained from a latex sample exuded from the lignified trunk of a fig tree was analyzed with permission of the original author (Dr. Sakihito Kitajima, personal communication) (Kitajima *et al.*, 2018). The sequence dataset is available in the Sequence Read Archive (SRA) of the National Center for Biotechnology Information (NCBI) (Acc. No. DRR101542). High-quality reads were extracted using the Sickle program (version 1.33; https://github.com/najoshi/sickle) using the parameter "-q 30 -l 50", and then assembled into contigs using the SPAdes Genome Assembler (version 3.13.1; http://cab.spbu.ru/software/spades) using the parameter "--rna" (Bankevich *et al*., 2012).

A total of 2,539 known RdRp domain sequences were extracted from 22 Pfam families (release 32.0; https://pfam.xfam.org) and converted to a BLAST-searchable database. Assembled fig transcriptome contigs were compared with known viral RdRp domain sequences using the stand-alone BLASTX program to identify putative viral genome contigs. The BLAST web server at the NCBI (https://blast.ncbi.nlm.nih.gov/Blast.cgi) was used for sequence similarity searches of viral genomes and proteins. ORFs were predicted using the getorf program of the EMBOSS package (http://emboss.sourceforge.net), with the parameter "-find 1 -minsize 150 -noreverse". ORFs were identified based on sequence similarity to known proteins. Molecular weight of a protein was calculated using the pepstats program of the EMBOSS package. The HMMER web server was used to predict Pfam domains of viral proteins (version 2.40.0; https://www.ebi.ac.uk/Tools/hmmer).

Pairwise identities of protein sequences were calculated using the FASTA or GGSEARCH programs in the FASTA package (version 36.3.8g; https://github.com/wrpearson/fasta36). Multiple sequence alignments were generated using the MAFFT program (version 7.450; https://mafft.cbrc.jp/alignment/software) with the parameter "--auto" (Nakamura *et al*., 2018). Maximum likelihood phylogenetic trees were inferred using the IQ-TREE program (version 1.6.12; http://www.iqtree.org) with the parameter "-bb 1000" (Nguyen *et al*., 2015).

Results and Discussion

Two different contigs (19,333 bp and 18,741 bp) derived from fig RNA sequencing data were identified to have an ORF showing a high sequence similarity to the citrus

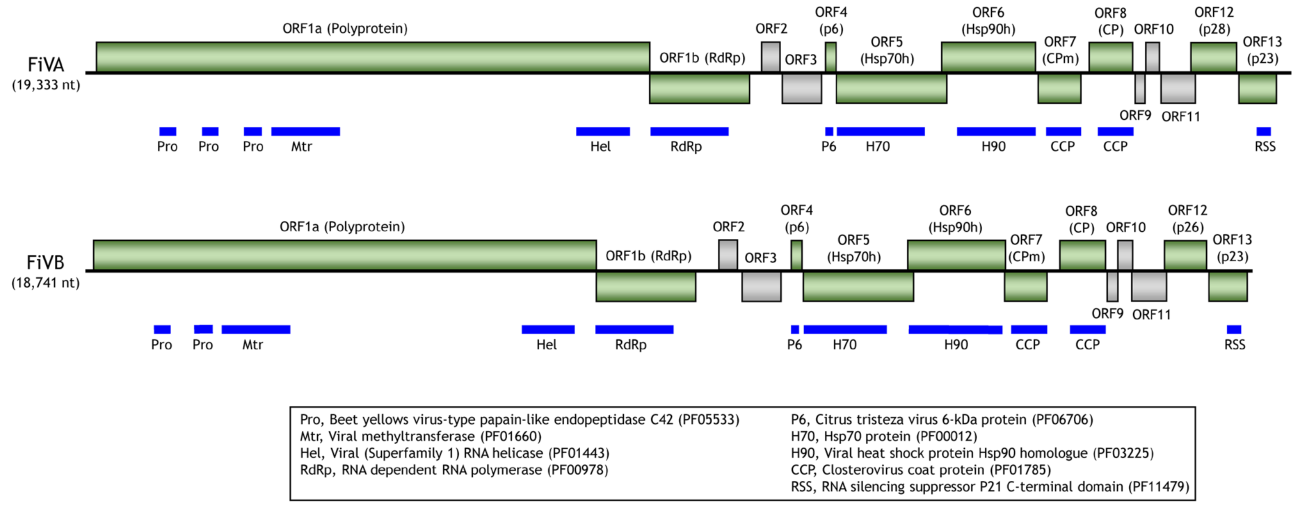

Fig. 1

Genome structures of FiVA and FiVB

Predicted ORFs are represented by boxes: green, ORFs with homologs in other closteroviruses; gray, ORFs present only in FiVA and FiVB. Predicted Pfam domains are marked by blue lines below the ORFs, and their names (as listed in the Pfam database) are shown in the box at the bottom.

tristeza virus (CTV) RdRp domain sequence. CTV is one of the approved species of the genus *Closterovirus* from the family *Closteroviridae* (Karasev *et al.*, 1995). BLASTX searches of these contigs against the NCBI protein database confirmed that they contained ORFs having similarities to those of known closteroviruses. Therefore, the two contigs were considered distinct novel closteroviruses and named fig virus A (FiVA) and fig virus B (FiVB). Their nucleotide sequences were deposited in the NCBI nucleotide database under the accession numbers MN817232 and MN817233 for FiVA and FiVB, respectively.

In the FiVA and FiVB genomes, ORFs encoding 50 aa or longer were initially predicted. Following this, orthologous pairs of ORFs showing significant protein sequence similarity (an E value of 0.001 or less using the FASTA program) were selected. As a result, a total of 14 ORFs (ORF1a, ORF1b, and ORF2 to ORF13) were predicted in each genome (Fig. 1 and Table 1). Pairwise protein sequence identities of respective orthologs ranged from 27.0% to 78.7%. Sequence alignments of 14 proteins with their respective orthologs from other members of the family *Closteroviridae*, if any, are presented in Supplementary Figs. S1a, S1b, and S2 to S13. Nine ORFs (ORF1a, ORF1b, ORF4, ORF5, ORF6, ORF7, ORF8, ORF12, and ORF13) had orthologous proteins annotated in other members of the family *Closteroviridae*, whereas five ORFs (ORF2, ORF3, ORF9, ORF10, and ORF11) were predicted to be present in FiVA and FiVB, but showed no significant similarities to known proteins.

Polyprotein (ORF1a) and RdRp (ORF1b) are present in all members of the family *Closteroviridae* (Fuchs *et al.*, 2020). Polyproteins encoded by FiVA and FiVB ORF1a were 2956 and 2688 aa, respectively, and contained three functional domains: papain-like protease, methyltransferase, and helicase. Interestingly, the FiVA polyprotein had three papain-like protease domains, whereas the FiVB polyprotein had two, which made the FiVA polyprotein longer. The closterovirus RdRp domain is produced by +1 ribosomal frameshifting, resulting in the fusion of ORF1a and ORF1b to ORF1ab (Agranovsky, 2016). The ribosomal frameshifting usually occurs at the ORF1a stop codon preceded by two uridines (Orilio *et al.*, 2018). The potential ribosomal frameshifting sites of FiVA and FiVB were cgcGUU**UAG**Cugg and cgtGUU**UAG**Ccuc, respectively, where the conserved stretch in two viruses is indicated by uppercase letters, stop codons (UAG) of ORF1a are in bold, and putative first codons (AGC) of ORF1b are underlined.

The ORF4 sequences of FiVA and FiVB were predicted to encode 6-kDa proteins with a domain conserved in p6 proteins of some closteroviruses including fig mild mottle-associated virus (FMMaV), rose leaf rosette associated virus (RLRaV), CTV, mint virus 1 (MV-1), and BYV. The p6 protein is one of five proteins (p6, Hsp70h, Hsp90h, CPm, and CP) involved in cell-to-cell movement (Peremyslov *et al.*, 2004). All seven analyzed p6 proteins were predicted to have a transmembrane domain that plays an important role in cell-to-cell movement (see Supplementary Fig. S4).

ORF5 and ORF6 of FiVA and FiVB encoded the heat shock protein homologs Hsp70h and Hsp90h, respectively. Two coat proteins (CPm and CP) were predicted to be

Table 2. Sequence identities of the Hsp70h and RdRp proteins of FiVA and FiVB and their respective orthologs

No.	Genus	Virus	Acronym	NCBI[a]	FiVA Hsp70h	FiVB Hsp70h	FiVA RdRp	FiVB RdRp
1	*Closterovirus*	fig mild mottle-associated virus	FMMaV	FJ611959	217/600 (36.2%)[b]	221/597 (37.0%)	147/285 (51.6%)[c]	137/276 (49.6%)[c]
2		raspberry leaf mottle virus	RLMV	NC_008585	222/612 (36.3%)	224/608 (36.8%)	265/538 (49.3%)	275/529 (52.0%)
3		rose leaf rosette-associated virus	RLRaV	NC_024906	216/606 (35.6%)	206/602 (34.2%)	261/539 (48.4%)	267/531 (50.3%)
4		Citrus tristeza virus	CTV	NC_001661	202/604 (33.4%)	211/608 (34.7%)	279/539 (51.8%)	276/529 (52.2%)
5		strawberry chlorotic fleck-associated virus	SCFaV	NC_008366	216/608 (35.5%)	198/600 (33.0%)	267/538 (49.6%)	274/529 (51.8%)
6		carrot yellow leaf virus	CYLV	NC_013007	215/625 (34.4%)	214/618 (34.6%)	242/540 (44.8%)	242/531 (45.6%)
7		carnation necrotic fleck virus	CNFV	NC_038419	182/611 (29.8%)	177/611 (29.0%)	246/539 (45.6%)	247/530 (46.6%)
8		mint virus 1	MV-1	NC_006944	207/611 (33.9%)	199/610 (32.6%)	246/539 (45.6%)	252/530 (47.5%)
9		tobacco virus 1	TV-1	NC_027712	196/612 (32.0%)	196/610 (32.1%)	250/541 (46.2%)	254/530 (47.9%)
10		Rehmannia virus 1	ReV-1	NC_040572	185/612 (30.2%)	195/611 (31.9%)	254/539 (47.1%)	255/530 (48.1%)
11		beet yellows virus	BYV	NC_001598	195/605 (32.2%)	208/602 (34.6%)	252/538 (46.8%)	253/529 (47.8%)
12		arracacha virus 1	AV-1	NC_040570	193/609 (31.7%)	196/606 (32.3%)	248/538 (46.1%)	255/530 (48.1%)
13		beet yellow stunt virus	BYSV	NC_043106	205/620 (33.1%)	213/616 (34.6%)	256/542 (47.2%)	253/531 (47.6%)
14		grapevine leafroll-associated virus 2	GLRaV-2	NC_007448	201/616 (32.6%)	199/608 (32.7%)	246/538 (45.7%)	248/529 (46.9%)
15		blackcurrant leafroll-associated virus 1	BcLRaV-1	NC_040722	192/609 (31.5%)	201/605 (33.2%)	247/538 (45.9%)	249/530 (47.0%)
16	*Unassigned*	blueberry virus A	BVA	NC_018519	166/625 (26.6%)	178/624 (28.5%)	221/539 (41.0%)	231/532 (43.4%)
17		Actinidia virus 1	AcV-1	NC_035453	185/613 (30.2%)	167/607 (27.5%)	182/574 (31.7%)	189/561 (33.7%)
18		persimmon virus B	PeVB	NC_025967	179/613 (29.2%)	172/610 (28.2%)	190/541 (35.1%)	192/539 (35.6%)
19	*Velarivirus*	Areca palm velarivirus 1	ArPV-1	NC_027121	166/608 (27.3%)	171/614 (27.9%)	151/549 (27.5%)	147/536 (27.4%)
20		Cordyline virus 1	CoV-1	NC_038421	152/602 (25.2%)	155/599 (25.9%)	137/547 (25.0%)	136/537 (25.3%)
21	*Crinivirus*	lettuce chlorosis virus	LCV	NC_012909, NC_012910	177/605 (29.3%)	170/612 (27.8%)	130/547 (23.8%)	131/537 (24.4%)
22		lettuce infectious yellows virus	LIYV	NC_003617, NC_003618	165/604 (27.3%)	170/604 (28.1%)	145/543 (26.7%)	148/536 (27.6%)
23	*Ampelovirus*	grapevine leafroll-associated virus 1	GLRaV-1	NC_016509	156/606 (25.7%)	147/603 (24.4%)	154/540 (28.5%)	153/532 (28.8%)
24		grapevine leafroll-associated virus 4	GLRaV-4	NC_016416	161/611 (26.4%)	150/602 (24.9%)	158/542 (29.2%)	159/536 (29.7%)

[a] NCBI Acc. No. for genomic sequence; [b] Amino acid sequence identity in the format; “Identical residues/aligned length (% identity)”; [c] FMMaV RdRp is partial.

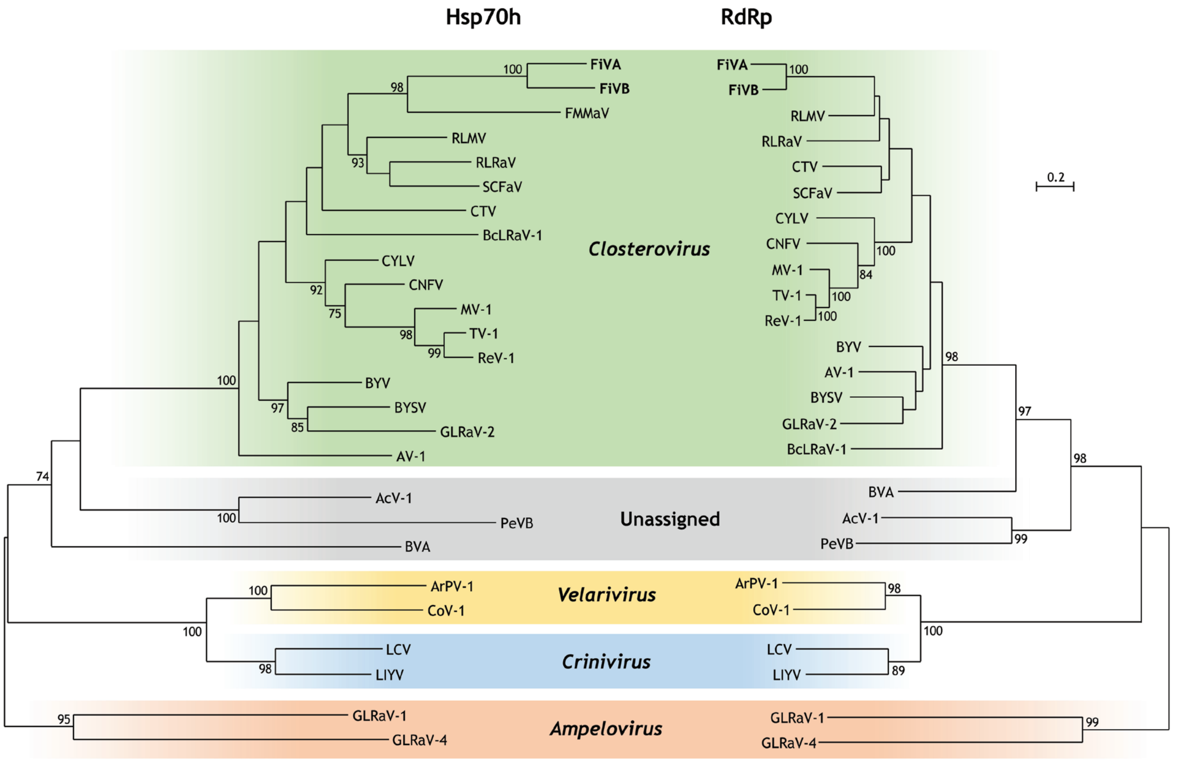

Fig. 2

Phylogenetic trees inferred based on Hsp70h (left) and RdRp (right) protein sequences of FiVA, FiVB, and selected members of the family *Closteroviridae*

Note that FiVA and FiVB form a subclade within the genus *Closterovirus*. The FMMaV RdRp, which is partial, was not included in the RdRp tree. Bootstrap branch support values of 70% or greater, calculated from 1,000 replicates, are shown at the nodes. See Table 2 for the full names of viruses and their NCBI Acc. Nos.

encoded by ORF7 and ORF8, respectively, of the FiVA and FiVB genomes. Hsp70h, Hsp90h, and CPm were known to be involved in vector transmission (Killiny *et al.*, 2016). They showed strong sequence similarities to respective orthologs of members of the family *Closteroviridae*.

The ORF12 proteins of the FiVA and FiVB genomes showed sequence similarities to the 29-kDa protein (p29) of three persimmon virus B (PeVB) variants, the function of which was not known (Ito *et al.*, 2015). The FiVA and FiVB ORF12 proteins were named p28 and p26, respectively, according to their calculated molecular weights. All five proteins from FiVA, FiVB, and three PeVB variants were predicted to have a signal peptide at their N-termini (see Supplementary Fig. S12).

ORF13, which is the last ORF of FiVA and FiVB, encoded a 23-kDa protein, which showed a similarity to the CTV p23 protein. The FiVA and FiVB p23 proteins were predicted to have an RNA-silencing suppressor domain, which is also found in p23 orthologs of some closteroviruses, including the CTV p23, BYV p21, and grapevine leafroll-associated virus 2 (GLRaV-2) p24. One of the functions of p23 orthologs is the intracellular suppression of RNA silencing (Flores *et al.*, 2013).

Five ORFs (ORF2, ORF3, ORF9, ORF10, and ORF13) had no homologous protein sequences in the current NCBI protein database. Hypothetical proteins encoded by ORF3, ORF9, and ORF10 were predicted to have a transmembrane domain near the C-terminus (ORF3) or in the N-terminal region (ORF9 and ORF10) (see Supplementary Figs. S3, S9, and S10, respectively).

Phylogenetic positions of FiVA and FiVB were determined using Hsp70h and RdRp sequences. A total of 24 sequences from representative members of the family *Closteroviridae* were collected (Table 2). FiVA and FiVB Hsp70h showed 24.4–37.0% sequence identities to Hsp70h proteins of selected viruses. Sequence identities between the FiVA and FiVB proteins were 56.1% (Hsp70h) and 68.8% (RdRp), suggesting that FiVA and FiVB are closer to each other than to other known closteroviruses. The RdRp of FiVA and FiVB showed 23.8–52.2% identities to the RdRp sequences of selected viruses. Conserved Hsp70h domain and RdRp domain sequences were extracted from respective multiple sequence alignments (see Supplementary Figs. S1b and S5) and separately subjected to analysis using the construction of phylogenetic trees.

The Hsp70h and RdRp phylogenetic trees confirmed that FiVA and FiVB are novel members of the genus *Closterovirus* in the family *Closteroviridae* (Fig. 2). In both trees, FiVA and FiVB formed a strong subclade with a bootstrap support value of 100%, indicating that they are the closest among the analyzed closteroviruses. The next closest virus to FiVA/FiVB was FMMaV, another closterovirus infecting figs (Elbeaino *et al*., 2010). These three viruses formed a subclade, which was supported by a bootstrap value of 98%, in the Hsp70h tree. Therefore, FiVA, FiVB, and FMMaV could be descendants of a common ancestral closterovirus that infected figs in the past, though they may have a complex history and simply were identified in figs. No ancestral nodes of the FiVA/FiVB/FMMaV clade had a bootstrap value of 70% or greater except for the node of the genus *Closterovirus* (100% and 98% for the Hsp70h and RdRp trees, respectively), indicating that the phylogenetic positions of three fig closteroviruses within the genus *Closterovirus* cannot be unambiguously determined.

To conclude, genome sequences of two closteroviruses, FiVA and FiVB, were identified by high-throughput RNA sequencing from a fig latex sample. Phylogenetic analysis confirmed that FiVA and FiVB are novel members of the genus *Closterovirus* in the family *Closteroviridae*. FiVA and FiVB genome sequences are useful resources to investigate the evolution of closterovirus genome organization.

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Supplementary information is available in the online version of the paper.

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Fig. S1a. Alignment of polyprotein (ORF1a) sequences of FiVA, FiVB, and related viruses

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FiVA       -------------------M----------------SKVPSSFPPNI------------PRVK-----------I-REKYFLFFKGPLTAADTP-GRVA--HRRRFVVKM-----    48
FiVB       -------------------M----------------TSVSFMFLPPD------------PDIT-----------I-IRSRRAPPTSPLKGLLKP-SPPI--PRRSSLPPF-----    48
RLMV       ----------------------------------------------------------------------------------------------------------MSPP-----     4
RLRaV      M--------------KTFYV----------------FADPDPPL------------------------------------------PVPGS----------PYVPPINPPFVDHA    33
SCFaV      ----------------MAGS----------------HHNPWPF---------------------------------------------IG----------------YSPG-----    17
CTV        ----------------------------------------------------------------------------------------------------------MSKL-----     4
BcLRaV-1   ------------------MA----------------SVSPMIAC------------------------------------------PSDAE----------------LELL----    19
CYLV       ---------------MAIVS----------------TQVQTHF---------------------------------------------AAS---------------FDQT-----    19
CNFV       ---------------MSAIV----------------PFVPVQLL---------------------------------------FHGEGASH---------------VRNV-----    25
MV-1       ---------------MAVCV----------------FAVPIFS---------------------------------------------SGN---------------LSVP-----    19
TV-1       ---------------MVLSI----------------FVVPSFS---------------------------------------------VAD---------------LNSP-----    19
ReV-1      ---------------MALAV----------------FAVPVFT---------------------------------------------IGN---------------LELP-----    19
BYV        ---------------MAFLN---------------VSAVPSCAFAPA-------FA------------------------------PHAGA----SPIV----------------    28
GLRaV-2    M--------------SSLAI----------------STLPCSVAQLS------------------------------------FGQPVAAV------------------------    25
AV-1       ---------------MAFLVDS--------------SMSPSASL--------------------------------------------------------------FNKQY----    20
AcV-1      MAPPRFLKASSGRAKASVAS-------RLNTRGECSKTLPKGWGVNSSFTVAHFFGAEDREVTFSRGCSRILDAYGLNPPPAVFYGPEPASPAFLKARANRELYSGVQRPFNSRK   108
BVA        -------------------------------------------------------------------------------------------------------------MY----     2
PeVB       MK-----RGSNGRCYEAVLRSAEDYLMR--------MTGPHGRYASL------------RS--------------AVKSPPSLGQWPLASDVALA--------LSGMFAPF----    64
ArPV-1     -------------------------------------------------------------------------------------------------------------------     0
CoV-1      ---------------MAFRS----------------SPLI---------------------------------------------------------------------------     9
LCV        ---------------MAVMS----------------HSLQLNDCVV----------------------------------------PLVGP--------------ALDSAC----    26
LIYV       ---------------MALEV----------------ES-----------------------------------------------------------------------------     7
GLRaV-1    ---------------MAVKS---------------------------------IFAQE--------------DLISIQKD---FRFPFVSS------------------------    26
GLRaV-4    ------------------------------------MPRPGSFSDDP---------------------------------------PLAAP------------------------    16

FiVA       -----------CQSLYKA-TLA---------------------------------------------------------------------------LPH---------------    61
FiVB       -----------LQSLYRA-PLA---------------------------------------------------------------------------LPH---------------    61
RLMV       -----------FGELLVE-V-ATDPE--------TLRYLEAVHAAEA---KAKLPTNLCRDIV-----------------------------LSLP-V-----------------    48
RLRaV      AIAWYNMGFEYRPHFYRA----------------------------------------------------KGN------------------------------------------    54
SCFaV      -----------SGSFIKT-------------------HLAPVYYADGGTLKSKL-------------------------------------------------------------    41
CTV        -----------RGSFWSS-AIAVNSDYTISRIWRKL-NTIVVLHYFGFVRITKV----IRDKS-----------------------------ADMPIV-----------------    56
BcLRaV-1   -----------EAEYLRSKALAAKPPSNEDPLS-------------ALCDRITFQREAAKDAV-----------------------------QSAA-LSACALTVVETRHV----    76
CYLV       -----------FNAFLSA-ATFTSPSF---------------YRLSVSQTLSKFIDKLSKNKV-----------------------------LVI--IS----------------    60
CNFV       -----------FNSISRS-CAGVSAQK----------RFALFTRL-CAPFTFNVTYVLTKDYI-----------------------------LCF--V-----------------    69
MV-1       -----------RLSFEIA-PATAVPG--------------------LSQLTFSMSDCTGKEIV-----------------------------LST--V-----------------    54
TV-1       -----------VASFVYS-AYGVVPA--------------------NAVKVFDFPAVTSADDA-----------------------------GCI--V-----------------    54
ReV-1      -----------EVSFTFS-AFGVVPT--------------------GACRAFDLPACYSADSE-----------------------------GAI--V-----------------    54
BYV        -----------PDSFPCV------PRYSDDISHFRL----------TLSLDFSVPRPLSLNAR--------------------------VH------LSASTDN-----------    73
GLRaV-2    -----------AKSFLMT----------------SL-------------------------------------------------------------------------------    34
AV-1       -----------ATSLLVS-MLAS---------------------------------------------------------------------MSLF-IAGSVDS-----------    42
AcV-1      AVRQA----AVAASLFEA----------------RR----------QRASKVHLPVVGKKRKAGPAFKAPKKDVVQHTTIPVVAPTVPVVVPTTFP-VAYVAKGATRL-------   185
BVA        -----------QHTFQRA-AARMSYQRSLNQ---------------THIRRTRLTRVVDSEGF-----------------------------TSF--VREHC-------------    46
PeVB       -----------PVGLFFA----------------------------------WLSRTSYR-------------------------------------VAHVTSHSAHVCRSWQTR    97
ArPV-1     -------------------------------------------------------------------------------------------------MSNGRS------------     6
CoV-1      -------------------------KRKQTKQT-------------NHNQTSLNHRKRVKK------------------------------------MKNLRKTKEY--------    42
LCV        -----------VPQLWSAGAVSCSPKNPNNNNN-------------NNKNQKWLNKNQTR-------------------------------------LGHVKTSEVS--------    72
LIYV       -------------------AFSLSYLLKENKQT-------------SNNLFSLIQVPYTK-------------------------------------MTHAKGKKTH--------    45
GLRaV-1    -----------STSLFLC----------------NL-------------------------------------------------------------------------------    35
GLRaV-4    ----------SHSSFPNP----------------------------TAAHQVWIPKTTYKNNTS-------------------------V-------ISGSTAHRTRKAEQERAQ    61

FiVA       --PSVGV-----SPRI------------------------RGGVPGHIPG--------------TRFLPETV-----YATPCGSTRPRPASLRAVLAAR----------------   110
FiVB       --PNQGV-----SPRI------------------------RGGVPGVVPG--------------SRTLLRVL-----YADASGICRPRAQSLRAL--------------------   106
RLMV       --PIRER-----RPR---------------------------PLPH------------------------VF-----CVNSAGVCSPLNER------------------------    76
RLRaV      ------------FPR------------------------------------------------------------QIFISSAGAISPYPES------------------------    73
SCFaV      --PVRTD-----RP---------------------------------------------------------------CTTAS-----ISSK------------------------    57
CTV        --PLRKS----VFPF---------------------------SVRAAVTSFVLLG------------VLLTL-----RIQGASVAFPLSTHLALFVP------------------   103
BcLRaV-1   -NRLRRP-----TPD--------------------------SQHRESLRR--------------------------RRSLCEGQQRPTRDSLSRASP------------------   115
CYLV       --PSKNF-----S--------------------------------------------------------FLF-----QLPSPISSSPLRYHPRKREP------------------    89
CNFV       --AVRRI-----SPS--------------------------AGVMIAVRR-----------------------------------------------------------------    86
MV-1       --PSTGV-----APSC------------------------TPSTLAKRRSILRRPTH----LPKGECTFYCG-----LTEGTAHRSPRRDIGKSF-P------------------   110
TV-1       --PV--------------------------------------GTRATDGS-------------------HCV-----RQPTSGEVKVPRHCGGV---------------------    84
ReV-1      --PVSAI-----G----------------------------DGVRA------------------------CP-----LLKASVASKVPFSVNRS---------------------    84
BYV        --PLPSL---------------------------------PLGFHA-----------------------ETF-----VLELNGSSAP----------------------------    97
GLRaV-2    --PSLQT-----YPSLSELTSFSF----------------CFGVFQNLKMFMSFLRS--VHVFASFSELSTFGSCYEFIRLGGGAHPL---------------------------    97
AV-1       -GPLMSLISL-CLSKVLKEGLGRL----------------TDGYTASATS---------------------------------------------------------------S-    75
AcV-1      --PEGTPVFLAKKPAARTLGFYPK------RAQREFIRLSLDGWSVTLDTESGVVTDQALLTLVKNYHYEAFLPLKLLAKHGAKLTPTLEYGWVRYDRNGRISRLLNLPYMW---   289
BVA        --PVRPT----TSPRNNFRRPAPRNPPAYAHGNRSAGPVPSGGTSSHSPR---------------------------RPSGSAAFVPPSGGGARFVPA-----------------   111
PeVB       FGPVRALTDMAKVPNVRVGGYSPP---------RRDSRCRLSGLAAAVHTLL-------------------------LTEGRRREADVISYGRQYV---G-----------WFSA   164
ArPV-1     -------------------------------------------------------------------------------------------------------------------     6
CoV-1      --KISKI-----NNKITSI---------------------TSALIEQRRRVY-------------------------IHEDTPLFDPPKSDKDWEIFS-----------------    87
LCV        --PASCV-----RSKVAF-----------------------------RRR-----------------------------------------------------------------    86
LIYV       --LLRCI-----LG-----------------------------------------------------------------------------------------------------    52
GLRaV-1    --PSPPI---------------------------------------------------------------------IFQKGSRFIAPTRSSNGFLRKAID---------------    64
GLRaV-4    -GPQSKFSNLTVKGKAALKGKGKQ----------------------------------------------------------ATDQPRKPSNKELATV-----------------   100

FiVA       --------LAARKL-------R--FAASTN-----------------RTRRFSRK------------------------------------------------------------   131
FiVB       --------LRDRRL-------R-------------------------RCRAPRRA------------------------------------------------------------   121
RLMV       ------------------------FLSSSR-------------------RRIVKR------------------------------------------------------------    88
RLRaV      ------------------------FRQASR----------RRARSERVARKSLKE------------------------------------------------------------    94
SCFaV      ------------------------MLGASR-------------------AAKLNS------------------------------------------------------------    69
CTV        ----------------------ALFAGFSR-------------------FSLCKP------------------------------------------------------------   117
BcLRaV-1   ------------------------FAEMAK-------------------RCSLQS------------------------------------------------------------   127
CYLV       ----------------------CVFYAQDG---------------------TIES------------------------------------------------------------   101
CNFV       ------------------------DATSPG---------------------VIIT------------------------------------------------------------    96
MV-1       ----------------------CLFVASGG--------------------ICHKV------------------------------------------------------------   123
TV-1       ------------------------FTKSGAS---------------ARSCVAKDS------------------------------------------------------------   100
ReV-1      ------------------------HTPSYGP---------------WFNKVVISS------------------------------------------------------------   100
BYV        ------------------------FSIPSRHIDF-----------------VVNR------------------------------------------------------------   111
GLRaV-2    ------------------------FFCSFQ---------------------------CG--------------------------------------------------------   105
AV-1       ------------------------FRRVPR------------ATRKRLSRSLLTH--------------------------VSGLFLNG--------------------------   102
AcV-1      ---EVLQLLKRGECGPKLRAYIESFQDNRGYCYLKLFRMANIAIGRSARRVGTVCHILGSFPSTREVQTVLYRRYACIPDFIVGYKSQGTRGHMTTTPIVRVSALPDLYWGADCL   401
BVA        --------SPGRRL----------FVDSRG----------------VAHRHFFNN------------------------------------------------------------   132
PeVB       GPSDAANLVQEGRADSG-GATALHFCRGCGVCRM-VFSPVRPACAKCGGRVSVSS---------------LMRREAPKPR-VSGKLKKATSADGWTT----------FYRERD--   249
ArPV-1     ------------------------YASGTGGLCW----------VNAFAYYNVKI------------------------------------------------------------    27
CoV-1      ------------RFN------MVHYTDMGHNFSF----------VGDEHYYVIMP------------------------------------------------------------   114
LCV        ----------------------------------------------------LVS------------------------------------------------------------    89
LIYV       -------------------------------------------------------------------------------------------------------------------    52
GLRaV-1    ------------------------YAVCCKNYGRSL-------------------------------------------------------------------------------    76
GLRaV-4    ------------------------YRSCGRVLSY---------------------------------------------------------------------------------   110
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FiVA       -----PLAS------------------------------------------SVSPS----------------------------------------LKKSP--------------   145
FiVB       -----PPAA------------------------------------------PRGQ------------------------------------------KKSP--------------   133
RLMV       -----PSVP------------------------------------------SESPTGVLPA------------------------------------------------------   102
RLRaV      -----PRVA---------------------------------------SPGVKAP-----------------------------------------FAQDP--------------   110
SCFaV      -----GVGP------------------------------------------RRTP------------------------------------------------------------    77
CTV        -----PLT-----------------------------------------------------------------------------------------------------------   120
BcLRaV-1   -----PRSV---------------------------------------ACDFSSTTGI---------------------------------TRDASSSHSPL-------------   152
CYLV       -----PVSR------------------------------------------HTAPS-----------------------------------------------------------   110
CNFV       -----PITS------------------------------------------RLPSEGKRFTG----------------------------NRYDTTMCSQP--------------   122
MV-1       -----PFTP------------------------------------------ENVNTSCLFV------------------------------RQDGRCSKVP--------------   147
TV-1       -----PVSS------------------------------------------RRTPRGVMYA------------------------------RTDGKLASSP--------------   124
ReV-1      -----PVIS------------------------------------------DTSPNRVLYA------------------------------KVDGTIKDSP--------------   124
BYV        -----PFSV--------------------------------FPTEVLSVSSLRTPSRLFALLCDFFLYCSKPG----------------PCVEIASFSTPPPCLV----------   163
GLRaV-2    -----PLSVSLGLVNGVFAVLNLSFPFLSNASLLMDVGKDVVQVKRKISKLEKKQKKRVFS----------------------------MARAAARYVPSP--------------   173
AV-1       -----PKSFL-GKGNFYVADKNCCCVF-SWSSIEY----------------DRSSKRFVFS------------------------------------------------------   140
AcV-1      MFGSIPASI------------------------------------PVVKAITSSPLKPGCS------------------------------VSPAESPKKPNILFGSFGATEPCP   450
BVA        -----PRPAS------------------GSAAFRAW-----PP--------FRPPRR------------------------------------------PP--------------   155
PeVB       --NSSPRSV----------------------------------RSEPVRATIRAPQPKRCA-S--------EGPSSSFKALGSYAAALLAPARAPKAVKRPNVVVAPVPAFSVWV   319
ArPV-1     -----P-------------------------------------------------------------------------------------------------------------    28
CoV-1      -----PATD---------------------------------------------------------------G------------------------------------------   119
LCV        -----P-------------------------------------------------------------------------------------------------------------    90
LIYV       -------------------------------------------------------------------------------------------------------------------    52
GLRaV-1    KFDATPVQS---------------------------------THHIIVKAVFRNTYYRAAS-----------GKWVTLR------------------------------------   111
GLRaV-4    -NSKIPASA---------------------------------PRPNGVSSASSSPKSYISS----------------------------SCSYHSSLSSGPKY------------   151

FiVA       -------------------------------------------------------RQHKTDL-NDYKKS----------------------------------------------   158
FiVB       -------------------------------------------------------KVNKTKINNDAKRS----------------------------------------------   147
RLMV       -------SSASFRNALREA--------GVSVPSFFFSFSPPASAGQL-----VLVRALKSPKQNNRKLT---LLITNYGLLLVRGDGASFSR-TRR--------SRPITAVGPCF   185
RLRaV      --------------------------------------------------------------------------------------------------------VEPVPSVTKSD   121
SCFaV      ---------AKVRRS--------------QVPEWILNHSSVAFDATL-----KIFKTIKSPKQNNPYNT---LLITSKGVLYVESLGNVYAKPTRG--------CVTRFAVGEQG   153
CTV        ---------SAAKRSLR------------QAKRESVSLSSRASSR----------FSREVPRGTRSRLH---RRVVRRAD--TAPVESPQDKPTRRN--SRLGKTSHLPYVGEAA   197
BcLRaV-1   ------------------------------------TFSASASDDITF--ANMYLNNLKSLCLVNAKRNE-MKVITTKRTVLFRG---YFRYPPTKQ---YDPAGRVVRSVSHPQ   222
CYLV       -------SEKEARKV---------------------FDFTRKFHNQ---------NKTKIMILSHDRGD---RL-----YL-------------------PLSRKRIINVTSVCG   161
CNFV       -------SVGSLSVSEH-----------TKVSIKSFDLKAQFHNR----------NKTKIIITNRQRTD---FFITDYCLV-------------------SDKVGKPVTAVTSSG   187
MV-1       -------CP-TARRSD------------AIVGKGGFSLTRQFHNR----------NKTKTMIINLHDGD---RFVTDRCTL-------------------LLSGGKPVEGTTCGG   210
TV-1       -------SRYQARRDV------------VIGGDHGFSLNKQFHDR----------TRTKAMIINHHDGD---RIVTDRSHL-------------------NLKTGKLLTGVSMNG   188
ReV-1      -------SKCPVRRNV------------TIGGPHGFDVTRQFHDR----------KHSKTMIINPSNGD---RIIVDRCVL-------------------SLNRGAIITGVTHDG   188
BYV        -------SNCVAQIPTHAEMESIRFPTKTLPAGRFLQFHKRKYT-----------KRPETLIIHESGLAL----------------------KTSALGVTSKPNSRPITVKSASG   238
GLRaV-2    -------RNPKEKRAVHVQPLP----------SGSFRFSQDK-------------NKTELIILSKEAGLV-ARVKCSACVV-------------RRRGYGGAVKSVALIALSPFG   244
AV-1       -------DLAMSLRLVQVSTLEVSRCFEVSYGTFVYRFVPKTFVKAF--------NKVSTFV--------------------------------RRQ------------------   190
AcV-1      EKPSVAMSKSAIRRLRRKNAAH-----RAGVH----NVDRKVDTAVVSPPPAVAPMRVETPPPVEGRKVAPPTTTFIKPIFRD---------------------------VKQCG   529
BVA        -------SPTVIRRSSSGASAE-----AATIRTPPF------------------------------------VRVVSRGIA----------------------------------   188
PeVB       RKGAVSGSPSVIRDLPRFAPVR-----GARV--------------VRAPVVSRCPKREEIPPVRPGGLE----------------------------------------------   369
ArPV-1     ----------------------------------------------------------KTLPF--VPKLFATQLI--KAGLP---------------------------------    48
CoV-1      ------------------------------------HYVNNVTTVND--------STLKVLKFRKARQCFSLKAVLNRIGLEL--------------------------------   158
LCV        ---------------------------------------------GI--------SPVEIQILSNGNALLVPQ---PRSFYK---------------------------------   116
LIYV       -------------------------------------------------------SPFETLT---------------KSSIR---------------------------------    64
GLRaV-1    -----AGTASGTVRLVRPAVV----------------------------------------------------------------------------------------------   127
GLRaV-4    SRPHEYTSLSDVQALVQHNTV----------------------------------PHVQAVKLSRPNGI----------------------------------------------   186

FiVA       ------------------------------------------VPFTPN---------------------PLKYAPMRAKPT----------------------------------   176
FiVB       ------------------------------------------YPILTGV-------------------IPDRYRVATRRPR----------------------------------   167
RLMV       STTVYISGKW--RRARVRGDA-KI--------------SPAARP---GV--ISHL---SPIP-------SVRKSKTKGSPF----------------------------------   234
RLRaV      ISSEFVDPSWGERKGKSPKLNYTM--------------GPSAAEFFFGAPVLGRG------------VCTRSSRLVRTVKSG------------K--------------------   178
SCFaV      PVPVFCSRRW--RKTPQTECN-SV--------------ASSSTPS-SGVRKLSQE---ASAL-------GKRKRLRKGSPF----------------------------------   206
CTV        LDDIL---RWIEEVNPHP----SM--------------VAIPVPITFGT------------------------------------------------------------------   225
BcLRaV-1   FCLSLHS-------------------------------KRGSSAFSKGGCNTARK------------GFPVSPKVTQRNTF--TE---------R------LV------------   265
CYLV       HRYTLCAPR--ERXAHSHRRK-------------------THVPFPRKSADRKKK---NKIPVRALNCKPSSEKDAAGKKK----------------------------------   218
CNFV       CLVTFFS-----------------------------------TPLSRSVELKTKA---SCSPL------PSSRSLKKKNHR----------------------------------   224
MV-1       RRISLFS-----------------------------------KPFTA-------------------------AKCGKGGPR----------------------------------   231
TV-1       GAYNLRS-----------------------------------TPFVR-------------------------RRNHHGEPKG---------------------------------   210
ReV-1      GAYLLRS-----------------------------------TPFSRKNF---------------------FRKGRIGE------------------------------------   211
BYV        EKYEAYE--------------------------------------------ISRKD-------------FERSRRRQQTPR------------VRSH------------------   266
GLRaV-2    VKFRCFA-------------------------------PSCSTSACLKLRIVRRVA-VGDCRGEKV-IAARRAELQKQNFNS------------R--------------------   294
AV-1       --------------------------------------GTPYSPPESTSTNLKRT--------------ILRKRFGRRSVASSFS------------------------------   223
AcV-1      GRLR----SWFGKVNPNERVKDRLASLLSADGSGYNYNGGSHRPDKRSKILLAELSSILKIDL----GWVKHALVQKYRPGSKIGAHKDNESCYRPLYNFRLVTINVFGEALFSL   636
BVA        ---------------PST-------------------PSEVAVPFYVDRNRLTQA----THSLQ----WVKKSSIRRAAPS----------------------------------   227
PeVB       ------------RVDDVPK-----------------PLYSAWVPVGNGGVITERP----HVKM----PVRKSAGVVRLSPKEGVS------------------TGSMMGEP----   425
ArPV-1     ------------------------------------------VNFLR------------HC------------------------------------------------------    55
CoV-1      --------------------------------------TKPQIKYLKK--NLAVKLGYSHCSLKFL-------------------------------------------------   184
LCV        ----------------------------------------TRLDMLRKICNIP------HCRFNRM-------------------------------------------------   136
LIYV       ----------------------------------------RSLKNLREVCNLP------YCNFKKI-------------------------------------------------    84
GLRaV-1    ----------------------ELES---------DHAGMFSVFFVRKQ--------------------LSEAPEKAKSPQCVID------------------------------   161
GLRaV-4    -----------------------------------YPRTPTQKVFMHKGQEVSSPQGLNSSPVRA----QQKVEAARAKPYATSD----------------------------GP   234

FiVA       -------KPWVGKPRTCQ--------------------------------YDDVPTTPLGSVVSAPPVV-------------RSVYKQPSADCFF--------------------   219
FiVB       -------KQWRGKPLTSL--------------------------------WDVCETSPQMPEPTALEIVP-----------KKTVVAQPSS-TVF--------------------   211
RLMV       ------------TPRTAA-----------------------------------YHACPSVEVRTAFNDT--------------VSNRTPAVRATT--------------------   268
RLRaV      ------------TERTAA-----------------------------------WRNAEECTQRTSYNPI-------------GSSVKAPEV------------------------   209
SCFaV      ------------TPKTAE-----------------------------------YHNSPVCETRTYYND----------------QQASPVV------------------------   234
CTV        ------------MPATAW-----------------------------------CSHSEAAVLRAALTIT-------------RLKLISPLRRNTYGTSIMTYLLPLTVPVRF-LP   279
BcLRaV-1   -----VRKTPSFKPKSAA-----------------------------------WHLVDASDHRTRFNAGE---------------------------------------------   295
CYLV       ------------NPRKG--------------------------------------DAFKPKSRN--------------------FDIAPRLP-----------------------   240
CNFV       ------------KPRTTF-----------------------------------NVNAFTFGSLHFVDG--------------ELLNGEPSFKNVHR-------------------   259
MV-1       ------------TPRRIS-------------------------------------HRFRTQSPNEINTLCV-------DSIVSLFEPLPVVK-----------------------   267
TV-1       ---------FNKIPRKS--------------------------------------VNIYTQPITEVNTLSV-------DTLCSLFEPIPPR------------------------   247
ReV-1      ------------TPLRSR------------------------------------VKSTFVQQKNHINVLPI-------DDICTYISPKVLA------------------------   247
BYV        ------------KPRKIN-------------------------------------------------------------------------------------------------   272
GLRaV-2    ------------TPKKVR-----------------------------------ENPAGALEANSEASATS--------RVIFFGSFTQPFA------------------------   330
AV-1       ------------IPRVFP---------------------------YTRNVMRRKVVTTYTAPPSTLNSIRIFGELMREDEPKIVVPKAPASFIYVGQIRIEL-------------   286
AcV-1      SRGAERYNIGLDGPCMFEIDPSVNFNFDHSVEVGRFFRGSITLRGHKSSNVL-DQSRLTTDVKRNIGSVVE---P--ERIIVSREKIGPSTVEDSGPAI-------SLPA---VE   735
BVA        -------AVPVSPPGPSS-----------------------------------PTVSAATSHTSEVSSVA------------SSSYVQPGR------------------------   264
PeVB       ---KKEVVQALDSPASGRKEPVLFF----------------------------SQEPATPGQRYSARSHGVLYYPVKEEPLPADKDAGPS--------------NDGAPADLGDE   495
ArPV-1     --------------------------------------------RVVSNNLLHFDNKYVQNAKIQLH------------------------NVSVGAE-----------------    85
CoV-1      -------------PKNVVYTY----------------------KRHTDNHILNLCAQGRNDNKVQCG------------------------RTYLGA------------------   222
LCV        -------------PQAVINKLGYDVD----------------KINEDIDQALNSKVGGTPENIRQPD------------------------ETIQGST-----------------   181
LIYV       -------------PKNISYKYQNPFL----------------KLYEINNNFINCKVGATGNTNSTYDWRN--------------------LSTI---------------------   129
GLRaV-1    -RKPAQSKIPVPTPIKAK-------------------------------------------------------------------------------------------------   178
GLRaV-4    SSGSNVPKGGVQNPKSGG---------------------------------------------------------------SSPVRQVPRRNNNRGTFKRA--------------   272
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FiVA      ---------------------------------FSFP-DDVEVNVRGIPKVRDAWTLDLKVRSFGHL----------LSTVKQ--IVQSHK------------PGYSSL------   270
FiVB      ---------------------------------YDFP-ASTEINQPGIPKNKDRWTLDLKVTSFGDL----------VRTATD--IIRRHR------------PGYTTL------   262
RLMV      ------PGARSVAP-----------------YVFSFP--PDTTSAGLLKQRPEGCRFLPNAHTEGDL----------MYHA-----LRYLRLYR---------PGGSKFSIGFYN   334
RLRaV     ---------------------------VHHKRGFSYP--EITHIFGGYDRHDVGSTFFTKERSLDRL----------VAMA-----VSRVKRHM---------PSATTL------   265
SCFaV     --------ARKSA------------------YKYPYP--SDTVFDSCGRVKPSADALFLKATSLDHL----------VKTA-----VRRTENHI---------PAVNSL------   291
CTV       ASASIFPSKSKLG--------------------VEVP--SGRDLHTAFVRSSHASAFFSDAVRASFV----------PSSAEQFFHFRRQRTHV---------LAITDP------   347
BcLRaV-1  ---------------------------------VTAP-------------------------------------------------VRRVNSELLQDVGDFVAPEFLVA------   322
CYLV      -------------------------------------------------DTERIS------------------------------------------------------------   246
CNFV      ------------------------------------------------SGREAATRNASNARHAT-------------KTAS---------------------------------   280
MV-1      -------------------------------------------------PADSITMFFGEFETVI--------------------------------------------------   283
TV-1      --------------------------------------------------RETVSIQFGSFDPLII-------------------------------------------------   263
ReV-1     --------------------------------------------------ADLVTIQFGTAEPIIIN----------TRTSQF---------------------------VPFTA   275
BYV       --KAVEP--------------------------FFFP------------------------------------------------------------------------------   281
GLRaV-2   ----LYPHQESAKAN------------------MQHPPVSVVTVERAV-----------------------------AKVAPERSVVDKVPTSV------GVSPQRGVFSPPTVV   388
AV-1      ------PTPDADGQ-----------------VGTQFP--------------------------------WLHKQGGLPKQASE--------------------PASSSVVTPD--   324
AcV-1     QSRSIPPSIRATGL-----------------EVATKPVVQGREE--------------IKTDHQSFLDA-------LTRCNSVGDIIDKSK-----------YPDYRAV------   795
BVA       ------SYASVVG--------------------SALP--------------SESSSVSSGSSPAAE-----------IKSSTT---INRI-------------------------   300
PeVB      EGLFVDPPSSDDGYGGCDATSDTTEDLRLYLSTPAEPPVKGSNAVGTP----------------------------TQRRVTNVGLIDTEAARR-------VSPDVQKK------   569
ArPV-1    --------Q-SNTH-----------------YYVNLT--SKIRLLIKI-------NIKTKTFSGCFQDI-------SDATSRDFLHFSS------------------RH------   134
CoV-1     -----------GAH-----------------KATNL----------KI-------NF-MYNHQAEYKDN-------EDATMADVRFLNTIKGITKCS-----LIVKLTH------   273
LCV       --------KYGDGY-----------------YVYNYD--NKSNVDILICFDSLVKNIYMCKFNLQLKYN-------KQGQAVDVL-VSLIKAYGKTQGQHFCKPFLLSQ------   255
LIYV      ----------GNGW-----------------SVTSYH--NDSVSRLHV---SMVNNI----------PN-------SNTKKLSWW-VTRVRSKNPWK-----RPYKVIY------   183
GLRaV-1   ------------------------------QVAAAVPGLNGNN---------------------------------AQSHARFGKFFNEGGSFQ--------RPAFLLR------   216
GLRaV-4   -------------------------------DAGPFP-------------------------------------EGDQKSLRSLKTVDDVRALK-------IFPSELSL------   306

FiVA      YTCFS------SRCGRVF----------------------------------------TRVSDS---GKLVFLCDAFNSNCVFSVKAPA---FLAHYNFCRKSGPLIPLTAFFRD   333
FiVB      YTCFS------SKWGRVF----------------------------------------TRVGTD---GRLFLLCDAYKSNCVFPFSAPA---FLAHYLYCNGKGPFSPLAVFFPA   325
RLMV      RYCFV--HFRESSTGSVF----------------------------------------V-------------ILQRPSSAVQFKFSCEA---YDLHRRFLITGVLSPRLLFLTGY   391
RLRaV     FTCFS------GPAGLVF----------------------------------------ARPKN----LREVDIFVNPLNAPKFRFTVVAV-WYAAHLCFLNGGD-IAPLLSLFRV   328
SCFaV     RTCYV------CKWGKVF----------------------------------------VTPINGV--YAEIKVIKGGQSAT-FSVRAPA---FCSHKIYFETGEGVESLNQFFKF   354
CTV       VLC-----------GTVS----------------------------------------V-------------LMSDGVNTARLDVVAPA---YYAY---------AESLGARVRF   386
BcLRaV-1  TRCKV-----LSGAGCLL---TRVADYLLSF-YAGHRTFYDFFRNGDDVVRLSVAGDFVRLHSNVAGVKKIFSLCAPRYSKYFSALKETR-DFSSFQM-----------------   410
CYLV      ---------------------------------------------------------------------------NPSVEVRLKPI-----------------------------   257
CNFV      ---------------------------------------------------------------------------TPCAVAAVDNLG----------------------------   292
MV-1      ----------------------------------------------------------------------------PLAPERAS-------------------------------   291
TV-1      ------------PLGR----------------------------------------------------------ETPPMETKFE-------------------------------   277
ReV-1     GQCDV-----VSTIGH------------------------------------------------------------PASEVR---------------------------------   292
BYV       --------------------------------------------------------------------------EEPKKDKRKRASLPTE-------------------------   297
GLRaV-2   RNCGD-----IVVTGVVHEALKKIKDGLLRFRIGGDMRFSRFFSSNYG----------CRFVANVRTNTTVWLNCTKASGEKFSLAVACSVDYVAMLRYVCGGKFPLVLMSRINY   488
AV-1      QAC-----------------------------------------------------------------------KGGSGQRSKPASSPAV-------------------------   343
AcV-1     --CQK------HTYGLVYV------------------------------------------------YHKDVLVKKGIFRRYYDLKALRQ-----------LNQITDNLRSYLSS   843
BVA       FRCGDLSYRFVVVGGIVH--PDDLENYLYRFSLG----YYPFLTS--QLYQIGVAQ--LTVCGNMI----KYVLTNGVSNVVENGSYAA-----AYKCWL-TREVSDDLNSTTNL   395
PeVB      ------AEGVPLFWGDVSS---DES---------------------------------------------VSSKESSSSKKRRRAAARKQ-----------GVRTVDNLEP----   615
ArPV-1    --------------------LYSRNPNYVRIALDCHL---------------------LRWMDKPS-------------------------NKKYSYQFYNPNSLLSELITSFIC   183
CoV-1     --------------------RFRKDNSYLGLSINAHY---------------------PAVGQTHK-------------------------ALDLEYLFYNPTTPIQTLTTKFVL   322
LCV       --------------------RLDTKQFYARVLL-------------------------ASVMQRIP-------------------------DYSAFYGVYMGK----LFCQRITV   296
LIYV      --------------------QRDFRD------------------------------------DGIK-------------------------PYVSEFILYAPKNRADLEMQSILL   217
GLRaV-1   -------------SGRLWD------------------------------------------------------------------------------------------------   222
GLRaV-4   -------------------------------------------------------------------------------------------------------------------   306

FiVA      ---------TVATDGYCYLRHMFECALRLG---APFFLKRCLLGPFPAFSVVRQRLVE------IYGESEV---FDWIR----------------------------G-------   392
FiVB      ---------RNSKEGFCYLKHMYECALRLG---APFFLRRSLLGEFPSFATVMERLKL------IYGESDC---FRFIR----------------------------G-------   384
RLMV      ---------QEPVNGFCHLGASLFVALSLGVAA--KYRPFINLGRFPTFATVKARCEL------VYGPEA-------------------------------A-LVK-GL------   450
RLRaV     ---------PDMQSGMCYLAHVFLVSLTLGVRG--RYKSFLSLGRYPSVEDFEHRLVS------VFGNDAL---SVAYR----------------------G-SSS-G-------   392
SCFaV     ---------PSVADGRCYLAHVFLVAVTLGVTA--KFWKFTSLGSFPSLKAFRVRLAS------VFGPEAL---DVAFR----------------------A-TIK-G-------   418
CTV       LWESSDVDDAKVRDGQCYVRHVFDVALYFGRRA--DLSVRRALGMYPTVGALKAYLVR------EYGRDSL---KVPMR----------------------G-TYTFG-------   460
BcLRaV-1  --------KTRPANGFCYVEHLFSVNLETGLSF--PFKKAFSLGAFPKASAVFDFISE------HISGDLR---RSSMS----------------------G-SFA-G-------   475
CYLV      ------------------------PNATFSSRK--PYLISE--------------------------------------------------------------------------   272
CNFV      -------------------AHVATPATSGACRT--PLGLEASLEKAPSKTTVHSRC---------------------------------------------------GF------   329
MV-1      --------------------------VVFSQPE--PESVEEVVPE------VH--------------------------------------------------------------   310
TV-1      --------------------------AVKEPEK--PIKVE---------------------------------------------------------------------------   289
ReV-1     ---------------------------VSVETK--PLSVS---------------------------------------------------------------------------   303
BYV       ------------DEGF----------ITFGTLRFPLSETPKEEPRLPKFREVEIPVVK------KHAVPAVV--SKPVRT---------FRPV----------ATT-GA------   356
GLRaV-2   ------------QDGHCYLAHMRYLCAFYCR---PFRESDYALGSWPTVARLKACVEK------NFGVEAC---GIALR----------------------------GY------   545
AV-1      ------TPEPARKDGSGQTSSVATVAAVTTERSPDLTSEDCFWEPIPPVKMLNKRLPV--------------EKGVAFR-----------MP-----------------------   404
AcV-1     ---------FRDSSGYCYLIYIRAVAMYFGRAETECSAAVRALGSWPKAGDLLSYIHK------RYGTCPAI--RVGYRHVGGAAVHADLTPVFLLANMRKGLRVG-GERACPIN   940
BVA       ----------NFGEGWCALKWFAMISHVENLPPA-FAHWKRALGRWPTLDSAISLLRY------EFPTWNV---RRVFL------------PFTLV-NADGG-HVS---------   467
PeVB      ------LPWNKLAPG---------VELTL------EERCKRPLALLPEVIEVLEVERKVNPSVFRFGKWTAW--AVLWAH----------H------------------------   673
ArPV-1    HVALK------------------------------NKLLRSILNYYPSRKF----------------------------------------------------------------   204
CoV-1     AGLGY------------------------------NDHTAWFWNYYPSKRFFFAKGEY------NALREVL---DKTTR-------------------ITQT-TLK---------   369
LCV       ARSVV------------------------------FTACQQYLN-----------------------------------------------------------------------   310
LIYV      SSVEC------------------------------FQDIKYALNYWTNLKF----------------------------------------------------------------   238
GLRaV-1   ------------IQGQCFFT----------------------------------------P---KFCHKWLL--TRDWSS---------------------------G-------   246
GLRaV-4   ----------RMQEHLCNLLDELNVHASDFARN-----------------FVLSRLRE---------------------------------------------------------   337

FiVA      -------SMGKRTFHC---------AFSGKICRLKPATPV----GGFDSDVL---------------------------------------------------------------   424
FiVB      -------DMRGRVFHC---------DFSSGLKTITDNCRV----GGSK-------------------------------------------------------------------   412
RLMV      -----PGNLRHGVFHV---------DLLSPLRAVFSDALV----GGF--------------------------------------------------------------------   479
RLRaV     -----------GVFHC---------DLTQDYAFVGAGELI----GGL--------------------------------------------------------------------   415
SCFaV     -----------KLAHC---------DLSSPLTDLPEDCIV----GGI--------------------------------------------------------------------   441
CTV       -----------SVFHCL------SLNLQVDLRSIPNHHLV----GGTSAHVLIGQVRVSVPGSIVKPSRSA-VRRRNRRMRRDGFLGSSGSSSSAGESTRCSDCSSPRGLPSPSV   553
BcLRaV-1  -----------GVFHC---------HRGGDFHYVDEATIV----GGLKK------------------------------------------------------------------   500
CYLV      -------------------------------------------------------------------------------------------------------------------   272
CNFV      -----LGATDHTIRNC-----------VRSSHHAPQLSVV---------------------------------------------------------------------------   353
MV-1      -------------RNA---------PTARSRRHRGR-GIN---------------------------------------------------------------------------   327
TV-1      ---------------------------ARRISPPGFPAVV---------------------------------------------------------------------------   302
ReV-1     ---------------------------ARPLS-----GVI---------------------------------------------------------------------------   311
BYV       -------EYVNARNQCSR-----------------------------------------------RPRN----------------------------------------------   371
GLRaV-2   -------YTSRNVYHCD-----YDSSYMRGFRNLS--GRV----GGGSFD----------------PSS----------------------------------------------   580
AV-1      -----------RDTECFSHR-----------------SYVK--HGD---------------------------------------------------------------------   420
AcV-1     STFIKVGTMECRISRC---------------------EPITPYSGSFRV-----------------P-----------------------------------------------V   970
BVA       -----------RDSKCV---ELEGTSLMR----------V----GGIKPK----------------PRSHA--------------------------------------------   494
PeVB      --------------KC---------------------GLI---------------------------------------------------------------------------   678
ArPV-1    --------------------------------------EV----NQMK------------------------AWQLNK-------------------------------------   216
CoV-1     ---------STKVAHN------EGTTKAVATKNPPVVKEV----PKIKT----------------------SATVQNRA-----------------DTNR------------PKV   414
LCV       -------------------------------------------------------------------------------------------------------------------   310
LIYV      -------------------------------------KEIC--NSALK-------------------------------------------------------------------   247
GLRaV-1   ----------KRYVFCFV-------------------------EGAVIA------------------------------------------------------------------   260
GLRaV-4   -------DKLKAISYCFLISN----------------------KGAIHF------------------------------------------------------------------   357
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FiVA         ------PLTLVSERD--------------------------------------------------------------------------------GSDFDVPSRGFINPR-----   448
FiVB         -------FALITAAD--------------------------------------------------------------------------------GTDFDVPAYGLINPR-----   435
RLMV         ----IGYAPPISW--------------------------------------------------------------------------------F-PKGVEFEK--FKK-------   500
RLRaV        -------PPVRVHRIK--------------------------------------------------------------C------------------------------------   425
SCFaV        ----YKALPLESR--------------------------------------------------------------------------------F-VKQAPVDEVDFKK-------   464
CTV          LKPSLGRIPSIDRRFRFPAGTQLRVSVPRRVDDHVYVSTGSNFDELCHAVLTRMSKGTTLEILLHSIRERKGLLGFAACFRWGSSHVFVKRGNF-TARFPISAVRYENQ------   661
BcLRaV-1     -----------------------------------------------------------------------------------------------ASPFNETTTYYAGGK-----   515
CYLV         -----------SR--------------------------------------------------------------------------------F---------------------   275
CNFV         -------VP------------------------------------------------------------------------------------------SLTTEQYKRV------   365
MV-1         -------TPAPTR------------------------------------------------------------------------------------NFKLSAEKVKNS------   345
TV-1         -------QPS-TR--------------------------------------------------------------------------------VRGEPMTLPKSKIRDL------   323
ReV-1        ---------------------------------------------------------------------------------------------------SLPKRKLKSL------   321
BYV          -------HPILRSA---------------------------------------------------------------------------------SYTFGFKKMPLQRFMK----   394
GLRaV-2      ---------------------------------------------------------------------------------------------L-TSVITVKTSGLPDSRPKS--   599
AV-1         -------------------------------------------------------------------------------------------------------------------   420
AcV-1        ERKECPKSPIRTTNV--------------------------------------------------------------------------------GLDVSLVRTAATKHLRGRQY  1005
BVA          ----CGESPP-------------------------------------------------------------------------------------SMPSALKALPVRRLSPML--   518
PeVB         -----------------------------------------------------------------------------------------------SSEEKLMRTRISKGLSPRAE   698
ArPV-1       ---IFLDTPIPTQQ---------------------------------------------------------------------------------PTTRRLQQTPEPSGVQ----   243
CoV-1        KPAVVVNTTIPTNK---------------------------------------------------------------------------------PTPIAITKVDKPSFIQ----   444
LCV          ----FMRSKVGVTK---------------------------------------------------------------------------------PEL-KVTQVPKKNNTP----   335
LIYV         ---RFTQTNIIITP---------------------------------------------------------------------------------VKP-RVVSVNKAREVS----   273
GLRaV-1      -------VPLEVIR-------------------------------------------------------------------------------Y---------------------   268
GLRaV-4      ---------------------------------------------------------------------------------------------F---------------------   358

FiVA         LLFAAFN-DV--------PSFPRKRS---------------VRRAYLSEGNLTKSL--------------------------------------DYIVR----------------   485
FiVB         LSFAAFG-AV--------SPFRGHRY---------------VRTTHLHEKDLVRAL--------------------------------------DYVVR----------------   472
RLMV         --------DI-------PFDLSGK-----------------DNTFYLRADDLPTAL--------------------------------------KYVTS----------------   529
RLRaV        --------DS---DY--PSDCPPT-----------------WESFYFRGKGVSRVV--------------------------------------NCVNR----------------   456
SCFaV        ---------A-------PF------------------------TGVLPVTKLDAVV--------------------------------------EFVTT----------------   485
CTV          --YAAVMMDV-------GTSWVPKGYVPDVDVVKRRRS--RNRRFPLSHRAVDQSV--------------------------------------PALQSSPVEVASVSSDKPSSS   727
BcLRaV-1     -----------------SYNLGGEQLAK----LPQPRN---KRCYRCKHVSFDNSL--------------------------------------DFLRY--VQA-----------   555
CYLV         ------------------LVIGGR-----------------LGLHATLTGDTDRCF--------------------------------------HSMLK----------------   301
CNFV         --HSANG-----------VTFGPY-----------------LGACYNSQLPPKTAV--------------------------------------DDFIR----------------   396
MV-1         --FVSVD-GV-------TVPLGGK-----------------VGHHYKFDGGYDEFR--------------------------------------TAVTD----------------   379
TV-1         --FSLYS-GE-------PLAIAGK-----------------VGLHHQHRSGFKVFK--------------------------------------DTVSE----------------   357
ReV-1        --FELVD-NE-------PLAIRGK-----------------IGLHYRHLSSFDKFK--------------------------------------LSIED----------------   355
BYV          ----------------------------------------EKKEYYVKRSKVVSSC-------------------------------SVTKSPLEALAS----------------   422
GLRaV-2      IVFGAFRCDI---RYIEPADSGGV-----------------QSSAKMKREEVRRVVKKCAAGEAAAQSRRKKIEEKYRDGIPDGGFPHLLAGNLNEVRRKVAAG-----------   683
AV-1         --------DV-------GFTIESKYSMM------------------------------------------------------------------VSLQKTYV-------------   441
AcV-1        RCKQAER-NVGPADSTSPSAAESQASCSA------------IGSSFRGCDSRKEYK--------------------------------------HLIGR----------------  1053
BVA          --------GL-------CSRFSGRSFCPA--V---------ISKAIPAGANVATII--------------------------------------RILAKM---------------   554
PeVB         ----------------------------------------------------------------------------------------------QKLTN----------------   703
ArPV-1       ----------------------------------------------------------------------------------------------RFTQRRF----QLGPNK----   256
CoV-1        -FGSL-P---------STHSFAVKEQA-----VKQPAQKPKPQSKPTSVNSTAQLVK---PPLAKEQP---KVAQK---------------GWVNVTRRKVV--TQPQPQKVEPV   520
LCV          ------------------QSCSVK----------------------------------------------------------------------HFVRRSG--------------   348
LIYV         ------------------SSVEVKL---------------------------------------------------------------------QRYEREG--------------   287
GLRaV-1      --------DM------------------------------------------------------------------------------------RVLWRRL------------PV   279
GLRaV-4      --------NAGG----------------------------------------------------------------------------------HYVGRVVVN---------EPI   374

FiVA         ----------------------------------------------YLRR-----YEVGESFIKD--------------------------------------QF-----IDGPY   506
FiVB         ----------------------------------------------YIRR-----YTPGAMMLYT--------------------------------------RF-----INGPY   493
RLMV         ----------------------------------------------RMNR-----FRIGREAVYS--------------------------------------RF-L----HSSV   550
RLRaV        ----------------------------------------------FIDT-----YQFPQSRLYS--------------------------------------HF-VN--ARGDS   479
SCFaV        ----------------------------------------------YLHN-----FALGDVRFFN--------------------------------------HF-IS--RNRRV   508
CTV          QKASSPSTSSSSSFNSTRSSDW--VNVGFSHRTTNKVREPRYAGHRRIGN-----FTFPRGTVYNTPVDERAYKRVLRLRDTTACSFLRILLARLSGYRPLSDEF-FNKCVTSRF   834
BcLRaV-1     ----------------------------------------------YVVN-----YVVAGGVFYD--------------------------------------KFRN--------   573
CYLV         ----------------------------------------------YL-------------TCYE----------------------------------PEVDDF-IVSFSVNGD   322
CNFV         ----------------------------------------------YL-------------SNYN----------------------------------PLHNDF-FTCLTAGVR   417
MV-1         ----------------------------------------------YL-------------SFYS----------------------------------PLRDDF-FSSVECGGV   400
TV-1         ----------------------------------------------YL-------------AFYS----------------------------------PYSDDF-FTSHDCDGV   378
ReV-1        ----------------------------------------------YL-------------SFYN----------------------------------PFDNDF-FSSFECGGV   376
BYV          ----------------------------------------------ILKNLPQYSYNSERLKFYD--------------------------------------HF-----IGDDF   448
GLRaV-2      ----------------------------------------------VLR------FRVGGDMDFH-----R--------------------------------SF----TTHSGY   705
AV-1         ----------------------------------------------YLKN-----YCVGGFKFIRT-IKGR--------------------------------NF----------   462
AcV-1        ----------------------------------------------LVDR---------------------------------------IL------------DF----------  1061
BVA          ----------------------------------------------YGR------------KIYG-----------------------------------IRVNYRL--------   568
PeVB         ------------------------------------------------------GYDPGCGNLFPS-----------------------------------RRRF-----LESLE   724
ArPV-1       -------------------------------------------------------------YLLQT--------------------------KFIGGRAT---EFRVFR------   275
CoV-1        KKVE---------------------Q--------QPVRD-------GVEL-----FKTKQGMLFKT--------------------------FRSGGKIV---KF-VFRL-----   559
LCV          ---------------------------------------------------------------------------------------------------Y---EFFVIKF-----   356
LIYV         -------------------------------------------------------------------------------------------------------EVFVVSK-----   294
GLRaV-1      --------------------------------GV------------YVALP--H-------LLFRC--------------------------------EDTGELF----------   299
GLRaV-4      ---------------------WFYGRVAGSNKGM------------YLSL--------GDGKTSKCFLKSR---------------------------FPTLREFLINDWAKG--   419

FiVA         LINLHVM---GKGTVRF------------------------EVK---------LYKKIFAWGDLCAP-RYTEHWRSV-FGNASCVVF--------EREFANGFCYLTHIFHMSVM   575
FiVB         CINLHPS---KAGRIGL------------------------EVR---------CDRKFFSCGEICST-TYVNHFNSV-FRDGRCVLY--------ERDFPNGLCYLKHIFHLCVV   562
RLMV         EFLLRPA---PGHCVYF------------------------YVR----------VNTTWAGFKFTCS-SYSAALSQQ-FTG-VLPPY--------HSKMPSGYCYLDILDRTAVK   617
RLRaV        EGVLVPL---GQGWIKV------------------------YVR----------IGTGWGVYFRKSH-ALSRVLSWY-VTGECAEPF-------FDEGSVEGLCYLSHLNRVSLE   548
SCFaV        EVCLVGT---TDKLVRV------------------------FIR----------MGSRWTSFDYEAL-EYAPYFLFF-KTGEVIPEY-------VDREFAEGYCYMNFLYYTSLT   577
CTV          VACIEPV---ESGLVKV------------------------HFR----------SDVFRASFPFDGQ-PIHPATA---LTLEVVVSWD-WMVTAFQNPLKDGYCYIRHFAEVSLS   907
BcLRaV-1     ------T---DASSVTV------------------------YVRNLKAVTYWQSGGDVSCATSYDAS-EYVNHFGELVLHVTNLSNYR-RCP-----RSINGQCYLQFVFECCVG   648
CYLV         RYNIKVR---GSGAVDI------------------------IPMFSDE------ITTTSASRDY-LT-TYRMRSRGY-IHDSILSRY----------HAPRGYCYLNHIFFLSLR   391
CNFV         REKFIVRRVSGRSSVAL------------------------IRR-CDK----H-VVSVVVNELY-CR-VLRMRTTKT-IDYGLLRMY----------KASEGFCYLNHLWFICLT   489
MV-1         NYNFTPV---GARRV-A------------------------VVR-SDG----RVVARLPASRDF-AE-VYRMQTTKS-FSGRLVSNF----------HSPNGLCYLNHVWFLCLI   469
TV-1         FYNVYPC---GARQV-V------------------------IKRLSDQ----KCVARLPCTREY-TL-MYEMHHRKN-FNGPMARRY----------SAPAGLCYLNHIWFLCLI   448
ReV-1        CYNALPY---SNDRV-I------------------------IRRVGDG----VVIARLPASRDY-LS-MYRMHLEKK-FAGPLARRF----------SASKGFCYLNHLWYLCLI   446
BYV          EIEVHPL---RGGKLSV------LLI---------------LPK-----GE-AYCVVTAATPQYHA--ALTIARGDR-PRVGELLQY----------RPGEGLCYLAHAALCCAL   520
GLRaV-2      HLLVWRR---SSRSVCI------ELY-------SPSKA---FLR----------YDFLPCSVDYAA--MFSFAAGGR-FPLVLMTRI----------KYLNGFCYLAHCRYACAF   778
AV-1         LIRIDAS-KPRMASLSV------------------------FVS-----GKIEYRCKFLCSKDYYL--AYKYYVGGSAFPVSWLFTY----------SAPKLKCYLNHMYFLCVI   535
AcV-1        --------KQDESTLNI------PLYEGFNVICVKNRPG--LVRILYKN---ILVKTVMANRYWDIQYLRSYGCVSK-SLKNYLYRY----------RDGEGYCYLRMLRLCCIY  1146
BVA          ----------VMDNVQF-------L----------------YRR---------------------AR-GLSGSVREA-RLGDILVNHGDRFIHSDDFSPIGGLCYRSWFKSADMT   627
PeVB         GMYYQPA---AENCCRICKDANCPSVFRRTSIPSEDVA---PVR--------QGVETPWRPVDVSVTSPDNQLLQSK-LNKGVRGIYL----NAIHKKEKNGYCYLNLFREMAF-   819
ArPV-1       ------N---AETPVIVKNQPG-------------------TAR--------IFFNNTLINRQYFIP-NEALMSNNK--------PYS---------SGKGGLCWVN--------   328
CoV-1        ------S---DESEYTILNDND-------------------AAR--------KMYNLTIKNKAFYIH-PECKVYNGR--------PFA---------FYKDAFCWVK--------   612
LCV          ------S---DGSEHRINNSRY-------------------AIK--------EMYNLTFNNGFYYIH-PMCYTPNYD--------RFG---------SCKNFYCWIP--------   409
LIYV         ------A---GKEDTRVLNDDN-------------------AIR--------NLFNATLNGGKYKLH-PEAKSATGK--------RFK---------YYKDGFCWLD--------   347
GLRaV-1      -------------------------------------------------------------------------------------------------YGDKYWCWLQ----LAVL   313
GLRaV-4      --------KSSSKHVTV----------------------FDPIK-------------------------------------------------NRNWRGDRGFRWLP------LY   449
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FiVA      TGCRF--------DELHAKRR--LGRFPTFSRLKFYLAKF------FG-NNSLGTHIIGWFT------GKNTFHAHLKKGKLYD--VRRMPAHVRIGGEIDIRQSLQLISYREGS   665
FiVB      SGSRF--------DEKHATQR--LGRFPTAARLRWYCSRF------FG-AHSLSWPVHGTFT------SRETFHV----------------------------------------   614
RLMV      RGYLH--------NADHTVRH--LGRFPTATKFRWFLQNF------L---PIRPTRVLASVTV----SRNNIVHIHTNGDG------RRI-------------------------   678
RLRaV     TGVPY--------RQDRAVAI--LKDYPTATKLRWYVKWW------FG-KSALKVPL----------------HCELNGKNVHA-------------------------------   599
SCFaV     VNRPF--------GVFTAMKT--LGKFPTATKLLWFIRSR------FG-GPGRKILVRGHFT-----SNKKIFHVDSTSS--------RI-------------------------   637
CTV       MGRIF----------FRRDVD--LGPFPYVFEVQHRLERL------YG-KAALRYGVRGQYS------APRCFHCCYNDSP------R---------------------------   964
BcLRaV-1  CGIAF--------DARKAIEA--LRILPTLKCLLAYVKSLGLVPPSF---------LRGYFT------SRTLFHCDINST-----------------------------------   703
CYLV      AGCAF--------RPAKNYFKT-LGRNPSATDLSARISAY------FG-FAAASYHIAGRYT------GYNRFHCDNSSR-----------------------------------   449
CNFV      GGLNF--------QGFSKTFKHLLGRLPRVFRFVNLLASF------FS-SGATHIAVAGKFV------SRGVFHVDNFFE-----------------------------------   548
MV-1      SGTSF--------LRARKYFGR-LGAFPGVESFFSLLCNF------FS-YHAVRIQIRGYFT------STGIFHCDNVRG-----------------------------------   527
TV-1      AGHSF--------NPARAYFSRGLGRFPRFSNFLGLVERY------FS-YPATRVSIKGYFS------RENLFHCDNFKG-----------------------------------   507
ReV-1     SGHSF--------SSARGTFLK-LGKYPRFSDFIATVGKY------FS-FPATRVGLMGYFS------AASTFHCDNFKG-----------------------------------   504
BYV       QKRTFREEDFF------------VGMYPTKFVFAKRLTEK------LG-PSALKHPVRGRQV------SRSLFHCDVASA-----------------------------------   575
GLRaV-2   LLKGFDPKRFD------------IGAFPTAADLRRRMVSV------LG-DRSLGLNLYGAYT------SRGVFHCDYDAK-----------------------------------   833
AV-1      NNHVF-------DEKAHD-----LGSLPSSGQLLKHIARV------F--PQSLNVKISGYFR------RNGNFHCELHRG-----------------------------------   589
AcV-1     FSKPM--------GYVRTARAE-LGSWPSSFAVKCFIRKT------FSKIPPVYVSLS----------RGRYAHVGLLPR-----------------------------------  1201
BVA       LGN----------RKMHKVVAT-LGAYPTLGRVVKELEKA-YKSDDF--PRKFYFRVVGRVLSA--SDAWSNDHCDFFTL-----------------------------------   691
PeVB      -SKAFY----LSDKRIRQIASE-LGPYPLCSAISEVLGDIG-----FD--------------------SNPIIHINGDARAIYDGMGNRV----------------QVV------   881
ArPV-1    ---AF--------AYFNKTIPKSLPFVPKL----------------YA-TQLIVAGLPAQFLKSCRMVERNLLHFDSKI------------------------------------   379
CoV-1     ---AF--------ASQNKKIPNNLQFMPMI----------------RV-SVLISFGLSPVFLNNVVITGKSLLHFDMKV------------------------------------   663
LCV       ---AF--------SKAKLRMPRDLVPYPEL----------------NY-GYLVQCGLEKVMRNRLRRVKDDYFHFDVNYNE----------------------------------   462
LIYV      ---VF--------ADANRRIPEWVKPHCLL----------------TG-SVLMSCGLWDFAKRKMVSVSHGLLHYDRKLE-----------------------------------   399
GLRaV-1   NGNNLL-----------------AGSFESCISVRKL-------------KRMLRFNVKLEKTD-----EANIFHVGNKPT-----------------------------------   358
GLRaV-4   LNSELP-----------------LTQYPTGGLVRLFTLYDK-----FGPAPIVK--------------SGKYYHYDVKGKK----------------------------------   494
                                                                                   *

FiVA      HELPAYGFVNPRLRFVPFEEAPVLENPKKILIMRLQERSLVHALDYVVRYVTRYEPTKCFLRTRFLFSVFTIDLFAPVSEEVKIIVKKGKDVYAWGDMMGENYAKHWRCVLNNES   780
FiVB      ------------------------------------------------------------------------------------------------SMLTKNFV-----------   622
RLMV      -------------------------------------------------------------------------------------------------------------------   678
RLRaV     ---TSYGS-----------------------------------------------------------------------------------------------------------   604
SCFaV     -------------------------------------------------------------------------------------------------------------------   637
CTV       -------------------------------------------------------------------------------------------------------------------   964
BcLRaV-1  -------------------------------------------------------------------------------------------------------------------   703
CYLV      -------------------------------------------------------------------------------------------------------------------   449
CNFV      -------------------------------------------------------------------------------------------------------------------   548
MV-1      -------------------------------------------------------------------------------------------------------------------   527
TV-1      -------------------------------------------------------------------------------------------------------------------   507
ReV-1     -------------------------------------------------------------------------------------------------------------------   504
BYV       -------------------------------------------------------------------------------------------------------------------   575
GLRaV-2   -------------------------------------------------------------------------------------------------------------------   833
AV-1      -------------------------------------------------------------------------------------------------------------------   589
AcV-1     -------------------------------------------------------------------------------------------------------------------  1201
BVA       -------------------------------------------------------------------------------------------------------------------   691
PeVB      -------------------------------------------------------------------------------------------------------------------   881
ArPV-1    -------------------------------------------------------------------------------------------------------------------   379
CoV-1     -------------------------------------------------------------------------------------------------------------------   663
LCV       -------------------------------------------------------------------------------------------------------------------   462
LIYV      -------------------------------------------------------------------------------------------------------------------   399
GLRaV-1   -------------------------------------------------------------------------------------------------------------------   358
GLRaV-4   -------------------------------------------------------------------------------------------------------------------   494

FiVA      YEVEERNFRDGFCYLKHVYHLCAVEGLKFDEKHATQRLRRYPSVAQFRRYVSIFFGKDLLAEYIK--GYFVRENVFHADLIDGNLYDLRFM-KSRVRIGG----DL---------   879
FiVB      ------NLRD-----------------------------------------------------VK--QYF--------------------------RIGG----EH---------   637
RLMV      ----------------------------------------------------------------------------------VDLFSLDR----SYRIGG----SDD-----GAL   698
RLRaV     ---------------------------------------------------------------------------------PRDISGFTY----TTRVGGSVV-QDA--------   625
SCFaV     ----------------------------------------------------------------------------------YNLAKMGY----TVRVGG----DDD----EKSL   658
CTV       -----------------------------------------------------------------------------------PMASFNG----YHKMGG----ED------NSL   982
BcLRaV-1  -----------------------------------------------------------------------------------RVVSVNKF-GGSVVIGG---------VTENSP   725
CYLV      -----------------------------------------------------------------------------------KLYTLEY--LREAAVGA----EGED--EEVNT   473
CNFV      -----------------------------------------------------------------------------------KFFSLRN--MGSSLIGG----GDE---KEQKK   571
MV-1      -----------------------------------------------------------------------------------NLFNHRYQRLRSARVGG----ENGEVPNEMVN   555
TV-1      -----------------------------------------------------------------------------------RLHSLSYNRINRANIGG----DAADSSDNIAN   535
ReV-1     -----------------------------------------------------------------------------------RVHWGSYRRLRFSRIGG----ETEGANEDLPN   532
BYV       --------------------------------------------------------------------------------FSSPFYSLPRF------IGG---------VEEEAP   595
GLRaV-2   -----------------------------------------------------------------------------------YIKDLRRM---SAVIAG----KDG--VEEVVP   856
AV-1      -----------------------------------------------------------------------------------RLWTLKAG---EEKIGD----DTD----ERAK   610
AcV-1     -------------------------------------------------------------------------------------VSLENI-PNFLKLGG---------------  1215
BVA       ---------------------------------------------------------------------------------DARDSSFDRY-----FVGG----PKD-LPSSVSI   715
PeVB      -------------------------------------------------------------------GHFTA---------SNFYFKLNLLDNPDMALGGT-RGPSETNAETEHI   919
ArPV-1    -------------------------------------------------------------------------------------IHNKWYNLNNVVVGA----SSSEIDEDS-L   404
CoV-1     -------------------------------------------------------------------------------------KNTKHINCHNYFLGA----ETTTIPNAD-S   688
LCV       ----------------------------------------------------------------KPH----------------FLKFGSKIGVK-----L----ENEA----DGI   484
LIYV      -------------------------------------------------------------------------------------RSSARAGVRD-FVGA----SNEAVQRED--   422
GLRaV-1   -------------------------------------------------------------------------------------VSLAEV-DDRCFVGMAAKGGQQSLVASVSN   387
GLRaV-4   --------------------------------------------------------------HIK---------------------------FPNVWVGA----QNQDVTDDITT   516

FiVA      ---VVNDASKMKV--VNLAFDKVMET--KDSIFVKSVEKSMIDFHQDFEELQKSRPKTQVTVALNESQQVALSKAYPEFQISFTHSSLSAHPVAAASRSLENELLHRWARR-DYT   986
FiVB      ---LTTDVDKMKV--VNIAFSKAAEA--KDSILTKSIEKHVIDFHQDFEAIQKSKTKSVVNFLLTDSQQVALSRAYPEFNISFTHSTLSAHPMAAASRALENDLLHKWVKR-DYT   744
RLMV      ---ALNDADRMKV--ISSVFATLSAN--RDSLLTKSLEQDLITFKSEIHDLASSKPQQRVPFSLNEADQIQLINAYPEFKLVFTNSVHSDHAIAAGSRSLENALLHKFA------   800
RLRaV     --CPPNDVEKMRI--ISDLMGKLQNN--RESILVKSIEKDLIDFSKSVSDLNKEKETVFVPFSVSERVQVVLTKSYPEFNITFTHSTHSDHGAAAASRLLENALLHKYAGS-NYS   733
SCFaV     ---ITTSADKLKA--LNLVYDKLSNS--RDSILVKSIEKEMIDFSAVIESLNKQKEAIKVPFRMGEQSQVALTAAYPEFNIVFSHSVHSDHPAAAGSRLLENALLHKYAVI-NYS   765
CTV       ---IITDTDRLRA--VGSAYEKVKRN-IPDSLLVRSVEKDLIEFNQTLVDMHRSRPGVVVPFQMSENQQVMLTRAYPEFNINFIHSVHSDHPVAAGSRALENHLVRKHAGT-DYS  1090
BcLRaV-1  --SLVQDQELLQA--VSSAISRSGVN--RDSLLVRSVETEAIRVNEAARNERNKRPSQVIPYQMSEEKQALLVNAFPEFNLKFTHSTLSNHALAASCRLLENGLHHKKAGS-EYV   833
CYLV      ---SLTDVGRVKA--LTQVHDSLRAN--RESLLVKSMEMDLVDFLNTTKNLQRGKEKLRVPFMLTEVQQSRLIPAYPHFHISFTSSSASDHPMAAASRLLENRTLVSFCSD-HFI   580
CNFV      ---FLDSYEKDQL--INQIVQTSRGS--KDSIVLKNVEMDLSNHADAMRRIMREKPSLRVPFQLNETQQAMVSRAYPNYDLIFTNTSFPDHPMAAASRLMENITLSDFCEN-DYA   678
MV-1      ---AITPLEKERL--INQLIETSRGH--KDSLLLKKMEVDLVEHVARLKRAQLEKPERKVPFHLTEQQQSHIVRDYPQYDILFTHSTHSDHPMAAASRLLENFSLSDKCGD-DFS   662
TV-1      ---VVTPLEKEKL--ISQLIETARGH--KDSLLLKKLEVDLVDHITRLKASQSKKPERRVPYHLTEQQQTLLVRDYPQYDLLFTHSSHSDHPMAAASRFLENNCLADKCGD-NFS   642
ReV-1     ---VVSPLEKERM--IAQLIDTARGH--KDSLLLKKLEVDLVDHISRLKRSQSDKPERRVPFHLTEQQQTVLVRDYPQYDLLFTHSSHSDHPMAAASRFLENSCLVDKCGD-NVS   639
BYV       ---EITSSLKHKA--IESVYERVSIH--KDNLLARSVEKDLIDFKDEIKSLSKEKRSVTVPFYMGEAVQSGLTRAYPQFNLSFTHSVYSDHPAAAGSRLLENETLASMAKS-SFS   702
GLRaV-2   --SDITPAMKQKT--IEAVYDRLYGG--TDSLLKLSIEKDLIDFKNDVQSLKKDRPIVKVPFYMSEATQNSLTRFYPQFELKFSHSSHSDHPAAAASRLLENETLVRLCGN-SVS   964
AV-1      ---VLTDLQMHEN--LERAMRGNFGG--REALINAALDRDTIEYKNALKALNESKPAVVVPFYMNEKTQSNITRNYPQYNLKFTHTTHSNHAAAASSRLLENITLTDACGS-GFS   717
AcV-1     --HVESDMSMRRMTEVNRLNAQVERAQLKDSALLRAVESTLIEEHRIERQMQSSKPVVNVNVSLNDSQQLALVKNFPEMRLKFVPSVHSLHPMSSAVRMCFNALYSQKLGKRKYI  1328
BVA       --NVLNSDEVVNC--HNRVSGILQRTDPSKSAFTKAVEFDMINEYNIVAQQSKNRGDIFIGYPIEDEHQSMLQMSFPEFHIRFVHSSYSDHPVAASVRLMYNHLFDSLYKDVGYI   826
PeVB      ------DIILPQL--RATVIDQISKSKISECMYARELEQQCLRIERERAQFMQGLPKLTIPHYLESAERSKLSSAFPELNIDFKPSKFSQHTMAACVRMCFNELYASKFRDIDYV  1026
ArPV-1    --QCNYDFTMQDL--VQKLLLKTQPK--ADNLTFTAI---LNKAVEQLHDWTRRQTDVSISVCLSINQKKIVAELFPEFKISYLGVSYSSHSLFTAVRELENYCIFNRFKGKSFI   510
CoV-1     --HENYDVVLDNM--LKKIFDKCSAK--SDNATLNNI---LSRCSQKLNCWFDRTPNLSLSVCLSVKQKKFFSELFPELKIDYLDKTFSSHALFTAVREASNYTYFKEMEFKNFL   794
LCV       --IKNIEVLFDDI--SAGIISGTQTR--SDNPLLTTI---TSHLSNEINKQCNKPKDLVIPTCMSSKQKKELCELFPEINFDFTESSYSTHALATAMRHAENYLLSKKYGFKSFV   590
LIYV      --FRDLDLRVEEF--AERVLETANLR--SDNRLIDNI---LTRASDYINKKSKESKELDINVCLSMDEKKMITNLFPDIQMSFNQKSYSNHGVFNAMRACENFYFSRKFKNSDYI   528
GLRaV-1   --ALNQEDLFEGI--VSTIANRLVLK--EGSTLVTHLDEKISELFMMKEDTLGKKNKCVVTVALSAVAKESLTRAFPELFITFLDSVSSSHSLCNAVRSCFNSLYASKYRGVPFV   496
GLRaV-4   WEDCNSDPLLRTA--VDSVLKRTVLK--ETSNFQTNID-NLFDKALTHTLSSTRNEKLTISQHLTAEEFELLKGYFGLPYLGNGNAPRNPHSLLNAMREVFNKLYAKTFRGVSVS   626
                                              :                      :   :       .   :    :         *      *   *
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FiVA      DIGGDLKNHV-VRGHTHVHVCRPVVDPKDAQRREQRLQEYAFCTPT-------GVDDAKVFEAVKTLTACAQLAHKCDVQSKTLVSVQVYDMNLQSLCEAMILKKAKISYLTMVT  1093
FiVB      DIGGCLKMHV-SKGHNSVHVCRPVYDPKDAQRREQRLLEYALIDPI-------NTDDEHMLEAVKTCSSCCSLVENCDVQSKFIVAIQVYDLPLLKLCQAMINKNSTIAYITMIT   851
RLMV      ----------------------------DSQRRVLRHHAYKRLKT------D-SATPSSILSATSSLSACSNPIDVCTHKSKVMTLVQVYDIPLPVLCESMILRDTEIAYLTMIT   880
RLRaV     DIGGCPRYHV-NSRHVSVHVCRPLMDAKDSQRRIMRHRGYDNMKL------D-SDDVSNLTAVSTLSFCCKSVEECTHKSKTFTMVQVYDIPLLTLFEAMVLRECDITYATMIT   840
SCFaV     DIGGCPKHHL-SAKHVGVHVCRPVLDAKDAQRRVMRHEAYKSMIM------D-TDKLSEVVSATSELTTCARSITDCTHKSKVFTMVQVYDIPLLDLCTAMEKRDCSITFATMIT   872
CTV       DVGGCPLFHL-RAGHSGVHVCRPVYDVKDAHRRVVRHHQLSKVSL------DQSDGVKQVGWTVNTNSVCGNILGECYHASEAMVMVQVYDVPLRELCRAMINKKTSVCYMTMVT  1198
BcLRaV-1  DVGGCPKYHL-LAGHTGVHICRPVCDLKDAQRKVLREHSIIATETLP------HNLYDKVTVAGCGLSACSKMMSECDVKTSCMVATQVYDLSLTDMANAMQMRGAAVFFFSLIT   941
CYLV      DVGGCPLHHYYFSKTKRVHVCRPVYDSKDAQRRVLRNTQLKSPLKAPLDEDGSSDAP----FVPSIHTSCAKVIDQCSYSADYMVMVQVYDVPLETLCASMSKRKVSVCYLTMIT   691
CNFV      DVGGCPKFHYEQTPTHRVHVCRPVLDSKDAQRRVLRNFELEKDSL------KRNVDVGDLTSLKNNLTSCSKVVGACHHKVRSMMLVQVYDVDLYELCNAMVTNEAKVAYLTMIT   787
MV-1      DIGGCPLHHYRNSKLKKVHVCRPILDSKDAQRRIIRNAEFRKPQK------HASKDVEENLYVNSLHTSCSYTISECRHTTPYMMMVQVYDVPLSTTCQSMINKGADVCYLTMIT   771
TV-1      DVGGCPLYHYHNSKMKRVHVCRPVLDSKDAQRRVIRNFELKKGSK------SNNQVPEDNVYVNSMHTSCSLTISECTFETPSMMLVQVYDIPLRELCEAMIKKSVNVCHVTMVT   751
ReV-1     DIGGCPLYHYHNSKMKRVHVCRPVLDSKDAQRRVIRNFEFKKSGR------GSSKEPESNVYVNSLHSSCSLTVSECTHETPSMMMVQVYDIPLRELCEAMIKKNASVCHITMVT   748
BYV       DIGGCPLFHI-KRGSTDYHVCRPIYDMKDAQRRVSRELQARGLVE--------NLSREQLVEAQARVSVCPHTLGNCNVKSDVLIMVQVYDASLNEIASAMVLKESKVAYLTMVT   808
GLRaV-2   DIGGCPLFHLNSKTQRRVHVCRPVLDGKDAQRRVVRDLQYSNVR---------SGDDDKILEGPRNVDVCHYPLGACDRESSAMMMVQVYDASLYEICGAMIKKKSHITYLTMVT  1070
AV-1      DVGGSPYYHQRNGREYEVHVCRPVYDFKDAQRKVCREHSMRKFCD--------SLSFAEKQKLSANMSICGKVMGECTHPSKALMMVQVYDASTVEVAAAMHAKGADVAYITMVT   824
AcV-1     DIGGDLKYHV-MKGN-DVHICNPILDPKDGVRYVNRVCEW---------NLAKVHDLNSMVVGSKKVSCCYTPAQNCDVSCSTAVAVEVYDISMTEMASIMAKRSIDRVYLTMLV  1432
BVA       DIGGDLRYHI-NNGHGDVHVCTPLIDAKDASRAVIRKLSWKGEPK--------TPLVNLALASETKRTFCYKDASLCDVSKDVAVMVEVYDVPFIKACSIMSCRGISMLHLALCA   932
PeVB      DVGGDLIYHS-MKGHVNVHICNPVEDFKDASRCAKRMQTWMS---------ATPGTAVASTSLSAPLRCCYSRAEVCDAMAPVITAVEVYDISVHLMAEIMHKKGAHVAYVTMVL  1131
ArPV-1    DFGGNVLSHY-RMGCKDTHICCPIVDIKDSARAIDR-----------------TLQLNNTVLHDVGITLCDKLAQKCNAQADRGCMVEVYDMSFVDIAEAMISHGIKQFFFYICA   607
CoV-1     DIGGNLFTHV-RAGTTDVHICTPCVDVRDSKRHMDV-----------------ALSLDRKLGEFDSYDICTNKAQDCHVSYDRAIAVEVYDMSLADMADAMIAHDCKRLNFSLLL   891
LCV       DAGGDITHYL-HKTVEDVHVCSPVVDLKDAHRHMTR-----------------SNKLDRMTGMCEKVDMCEHLTQECNVERPNIIAVEVYDMTLEDFARALRSHKAKRVDFTMII   687
LIYV      DAGGDVVSTL-RSKNHNVHICSPRLDLKDAARHIQR-----------------ATVIDGLKGYGETISFCTNKTEDCAVNRDIIIAVEVYDMTLRDMAKAMLSHGSRKFEFSCII   625
GLRaV-1   DIGGSVAYHV-RNGDKDCHCCNPVLDYKDCRRREEECLRLATAEEKVM-----TVESVLKKEAAKNITYCQMDTRFCDHKAPVGFMVDVYDLDVFELAQALEKKDIKIFELCLMF   605
GLRaV-4   DIGGNLSTAV-FSDCSNTHICMPILDAKDAARQTRSAIALFNSLDRKI---EGEFLLAKRLQTLNNISFCHDAVPKCAVKSTAIVMVDVYDMHLKLLIKAMEKKGALIARCCFMF   737
                                      *  *                                     *      *          :***         :  .

FiVA      PGELIDKRENFYLPLLECEVSVDAANDVVNYAFGSSV--YSHRLSAVVEYM-KRPFVVIGHNLFTIEMFSIRCDVNYYKITRS---EYCPQLSGVKILRYKRADSGITRIRLPVF  1202
FiVB      PGELIDLRRNFLIPTLECEVAVNPAMNSISYAFGSSV--YTHQLSTITEYM-KTPYVVIAENLFSIEMICVRCEVNYYKIVRS---QYCPRLSGVKTLRYKRADSGITRVRLPVF   960
RLMV      PGEIVDKRLAFLVPQLNCEVEIKPQEDLLLYKFSSST--FSHSLSVVLSYM-NTPCYVSGGYFFSVEMFSARCGVNYYVVTKS---DVCPKNSFTRRLRFKRCDPDVTRVKIPRY   989
RLRaV     PGEILDGRTQFYVEDLECEIKINEGEDRLVYAFPGSV--YTHSLKTVLGYM-KNPLTVYKDYLFSVEMTSLRSSVNLYVITKS---SVYPDIRQTKLVRFRRCETDVVRVKIPNY   949
SCFaV     PGEILDGRSHFSVESLNLEIEISSDEDLIVYRFAGSC--YSHSLKTVKGYM-TTPYLKLGKYLFCVEMNSLRNSVNHYVITKS---EVSPLIRGPRHLRFRRAEHGITRVKIPKY   981
CTV       PGELLDARESFFIKDLDCSVELDPIADRVVYCFNNSA--YTHTYSTICECM-RTPCLVVDGFLFTIEMVSLRCSVNYYCITKS---SVCPRISETKRLRYRRCDSDLIRIKIPRY  1307
BcLRaV-1  PGEFLTDRDAFRLSALEVDIIVSREDDRVTYVFGHTT--YSHSLSNLLTFM-QTSHFRLGSDLFSVEMYEVRCGVNFYQMTRS---SRCPKYEGSHLLRFPYADPGVTKVKIPRF  1050
CYLV      PGEILDRREAFHHGVLNCDITLDVGSDTITYKFGSSC--YTHTLSTITQYM-TTPVYSYENNLYSIEMTGERCGVNYYVITRS---EVSPAIDCQKVIRYRRCCEGLVRAKLPKF   800
CNFV      PGEILDMREAFRCDIINCDIELDSHKNILTYKFGSSC--YTHSLSTVRKYM-TSPVVVIGQYLFSIEMTGVRCRCELLRDNRSP--EVAPMIRTDKVIRFRRCCQDITKITLPRF   897
MV-1      PGEILDRRECFHHDVIGCDISIDIHRDSIVYKFGSSC--YTHDLSLVTEYM-KTPVYVLGGYLFSIEMVEVRCGVNYYVITKS---DVSPTIDCSKTLRYPRCCLELVKVKLPRF   880
TV-1      PGEILDKRECFHHDLLGCDITIDIHEDSITYKFGSSC--YTHDLSVILGYM-TTPVVVVDNYLFSVEMVEIRCGVNYYVITRS---DVCPSMDCGKTVRFQRCCMDLVKVKLPRF   860
ReV-1     PGEILDKRECFHHDLLGCDISIDVHGDSITYKFGASC--YTHDLSVILSYM-TTPVLLLNNHLFSVEMVEVRCGVNYYVVTRS---DVCPAMDCEKTIRFQRCCLDLVKVKLPRF   857
BYV       PGELLDEREAFAIDALGCDVVVDTRRDMVQYKFGSSC--YCHKLSNIKSIM-LTPAFTFSGNLFSVEMYENRMGVNYYKITRS---AYSPEIRGVKTLRYRRACTEVVQVKLPRF   917
GLRaV-2   PGEFLDGRECVYMESLDCEIEVDVHADVVMYKFGSSC--YSHKLSVIKDIM-TTPYLMLGGFLFSVEMYEVRMGVNYFKITKS---EVSPSVSCTKLLRYRRANSDVVKVKLPRF  1179
AV-1      PGELFDDRSVFLVEDLDCEVSME--GDRITYKFGSSC--YTHSLSNLRNWM-RTVYLIDYGCLFSFEMYETRMSVNYYKVTKS---SYSPSINSVRWLRYKRVGSDTVKVKLPRF   931
AcV-1     PGELFDANSVT-VCVPEHDIAISQEGDNLIYNMPAGQ-SYCHDRSSVLSYI-TNPYMLHGNQLFHSEMVGHRCGVCEFRVTRV---PVYPAIDTIIHITIPRATSGLVELHLPNI  1541
BVA       PGELIDDHIKV-IDVPHLSLRIEKVGDRVHYSYGAGV-AYQHDIADIQSWM-KATTMTIGDDHFFCELLGVRAGISEYRVTRS---KNQVSSGTTKVISIPNAYQGHVLVKLPSL  1041
PeVB      PGELIAMKDGS-CYCSALGVEIRMKGDDVLFNYNGGL-GYTHKRQVMESWF-RYPCFVHNQCMYTVEMISNRLGVSEITVTRA---PFYPKVDCTLLVSVPMIEKDMTVLYLPEY  1240
ArPV-1    PGELLSDFDT--INLYNGACTIVRTGDRVTYYYGGSTEGYTHNLTKLRELM-SRHFIKINGHCFRKTLELSRGPFQLFSIVLV---PSIPAGTYNFTTRIANHQVSKILVKVPVT   716
CoV-1     PGELLEDFST--IYLFDQSCKITKDGGVVSYYYGNSAESYDHSLEKLRDIM-INQVVIRSGKIFKKTLEKSRGPFRYYPLVLC---STMPSGIQKFKSLYDCYQSNKVIVKVPIS  1000
LCV       PPEIYDEDCD--VSLFDDTVNVKCEGNIVKYTYGDSGEVYSHNRDNLKQIL-ATQIFEVDGVIYKKTLENSRKQLHFYSVVPC---SDMMNGSYVTESHYSRSEMDKLCIRVPVE   796
LIYV      PPEIFTKECN--VELYEGRLKVTRIGDNVEYYYGSNGETFSHSCQTLKDIL-SVQVFQFGGRVFKKTLEHSRGQLHFFSICIC---EKIEPGSVKLKTYYQRSELDKVTLRIPVK   734
GLRaV-1   PIELTARDGS--LTIPELGVEVVRKGDVIMYTVGGVGDAYTHSVQKIISFFGSNVVQLPSGSAFSVEYVGYRLGYHQFSLCVI--DTAHASYNLTR--KVSTTFKGHSLVMIPEI   714
GLRaV-4   PPELLNIDGI--VVHPETSVVVTRSGQTVSYNIANTADSYTHNLENVMSFLKTSSLRSDTGFLYSVELVNQNGPYMDFQIALSRGTSTKPGLR-----SFQAWLKNKSEVIVQKL   845
          * *:                 :      : :        : *    :   :            :       .                                       :

FiVA      DAKLKTC-SHRCNYIYLETKFVSQVYEYIVNTCTQINSKTFEWAWNYVKCSKSRVVISGKVIHRDVTIPLEHMEAFVAVMLAAGVKARMSAEYFSKKL-AVISGDATYAQMIKYA  1315
FiVB      DAKLKTC-TNKNEYIYVETKFISQVYEYIVNTCSQINSKTFEWAWNYVKCSKSRVVISGKVIHRDVSIPLANMEAFVAVMLAAGVRARLSAEYFSKKL-AFISGDASYYDMIKYA  1073
RLMV      NVKTKTC-LPGCDYLYLDSKFVSKVFEHVVNTCTVVNAKTFEWTWTYIKSSKSRVVISGKVVHRDVPIDIKYLDGFAAVMLAAGVKSRQGAEFFSRRL-ALYTGDASYYQMLEFA  1102
RLRaV     CAKTRVC-KPGHKYLYLDSKFVMRVLGHIMNTCTVVNSKTFEWAFTFTKAATSRVVVSGKVVYKDVALGIENLDGFVAVMLAAGVRSRQNSEYFSKKL-ALYTGDASCFQLVLFA  1062
SCFaV     CSKTRVC-LPGCDIVYLDTKYVSRVYEYIMNTCSVINQKTFEWAFNFAKSAKSRVVISGKIIHREINLPMKYVDGFTAVMLAAGVKAKQNAEFFSKRL-SLYSGDASYLQLVMFA  1094
CTV       SSKTRSC-LPGCYYLYLDAKFVSRVYEYVVNNCVVVNAKTFEWTWNYIKSCKSRVVISGKIIHRDEPIALEYLDGFSAVMLSAGVKGRQNAD-VSRRL-AAFSGETSIFELVGFA  1419
BcLRaV-1  DRQSRCC-LPGADYLYLDADFVEKIYLFTVNACQNVNSKTFDYVWNHIKNAKARLVISGKIVRRDVSLDISEIESFAAVMLAAGVRSRLTAECFSKKI-SLAVNEMSISSMLKYA  1163
CYLV      CKKTRKC-LPGVDYVFVDADFVERIHQYVIGNCSVVNSKTFEWTWNYVKSSKSRVVISGKMIQRDVSISLDQMEPMVVVMLAAGVRSRQASEYLAKNV-ALYTGGASILDVLLFS   913
CNFV      CKKTRRC-LPGVETIYVDSKFVNRVHEYIVGNCNTINSKTFEWAWNFVKSSKSRVVISGKIIHRDVSIGMEHLEQFVVVMLAAGVRSRSTSEHLAKNV-ALFAGESSLLDVAKFA  1010
MV-1      CKKTRKC-LPGIDLIYVDRKFVERVYEYVVGNCSVINSKTFEWTWNFVKTSKSRVVISGKIIHRDVSINLDNLEQFVVVMLAAGVRSRMSSEYLAKNV-SMFAGDASFSEIVRFT   993
TV-1      CKKSRKC-LPGVDLIYVDRKFVERVYEYVVGNCSVINSKTFEWTWNFVKNSKSRVVISGKIIHRDVSINLDNLEQFVVVMLAAGVRSRIASEYLAKNI-SMFAGDASFMEIVCFT   973
ReV-1     CKKSRKC-LPGVDLIYVDRKFVERVYEYVVGNCSVINSKTFEWTWNFVKSSKSRVVISGKIIHRDVSINLENLEPFVVVMLAAGVRSRVASEYLAKNI-SMFAGDASFCEIVGFT   970
BYV       DKTLKTF-LSGYDYIYLDAKFVSRVFDYVVSNCSVVNSKTFEWVWSYIKSSKSRVVISGKVIHRDVHIDLKHSECFAAVMLAVGVRSRTTTEFLAKNL-NYYTGDASCFETIRFL  1030
GLRaV-2   DKKRRMC-LPGYDTIYLDSKFVSRVFDYVVCNCSAVNSKTFEWVWSFIKSSKSRVIISGKIIHKDVNLDLKYVESFAAVMLASGVRSRLASEYLAKNL-SHFSGDCSFIEATSFV  1292
AV-1      DTRNRIC-KSGVDILYLDAAFVKRVFEFTVCNCSVVNSKTFEWVLNYVKSNLSRVVISGKLVHRDVKLPLEHTGPFSAVILAAGVKSRQHMEALAKNL-QMFSGELGFLASLKFL  1044
AcV-1     NKVSDVLDFDNITSVMVDYDFFTRALTHIINVCTNVSEKTFEYTMTWLRNNSARVVISGRIIHTNVKLAPEHIGRVAALLLTAGVKTRWESGRYARRL-YRAVGQETLWESIKTT  1655
BVA       DDNLLVS-KSKTAIRFVNCDFFMRCYVYGLKNCTQINEKNYEFMLTYMNNAMARSIISGKVVQSQCVMSPEDFAPMAALFLVVAVRKRHYNAMYARKV-GFRVGELSVFSVISDV  1154
PeVB      NLDTGLFDFTKQDCIKVDRRFFSEGLVYVMNNCVCVSDKHLEWVCTWLRQNKSRVVISGRVIHNNVYLPEKLVSRVAALLLVVGVKSRVMSSRYAKGLVRAYDSSESLFMQLWNR  1355
ArPV-1    DKFGNIT-L---TDLIVDKSLVINLVEYTANCIEGINKKGFEHLMSQFRSRKAFKIYNNKVINEEVEIPLELLEGFLATIMATGMRINDKTCYLARFV-YNTYYCPTIIKVILFG   826
CoV-1     DINGRIT----TQEIMINKSFVVNMVEYAANCVDNFNRKGFEYVMSHYRSRKSYVIYNGQVMNEAVNIDLKYLPGLLAVMLSEGLRMAERTNYLARLV-YYQYYAPTLLRCVLQG  1110
LCV       NELKTIE----HMKIKMDKACFHNLVEYAMNTVLRLDEKAFEYILSQYRARKSISIRGGKVTQVGADMHPKAVAGLIGAVAGYGLRLREQSHKAARVA-YLEYYTPSLFGMICKI   906
LIYV      DSFGVVT----HYIIKEDREFVSSMIEYVANTGIKIDDKMVEWTYSQYRAKKTVTIKSGKVTQKETRIRKELIPGFIAIIMSEGIRAREKTHYLAKML-YTSHYKPSIVNIIFRL   844
GLRaV-1   ADG-----FLSFRQMYLDSDFVDRVYSYLLNTTSAFVDRTFEYAVSCARSQKTHVIVGTRVVHDKVELSPEEQWGLVVALMIQAITDRKKAHVAHHSI-EALRGN--LWNCIVLI   821
GLRaV-4   LDDGSVSNL----KLIVDRDFVRRVLSYSANVCNTLDDRTYEYVLSDIRSQTTMMIVGSKIVHNKVDISNDVIVELPGTFLKEAVKRRRRAVEQAKKS------NPGFFRKLLAN   950
                           :   .     .       .  :  :   .  .   :  : . ::      :       .   .   .:          :

FiVA      VTEKLKSTLSSLNHKITEYLKAILSDAFDVQFLTQERAFE---DVTEYAEVQV-AYDLKP------FGSVPD----------------NEELNVLVENIE---------------  1389
FiVB      ISEKMKSILAVVNTRVTAYLKAILSDTFDIQFLTDERCFE---EVSEYAEHNA-SYQLEQ------FGSVKD----------------NEEMNTIVNSIT---------------  1147
RLMV      IGEKFRSVMQDFDKYLATKIKKMLKDAFSLEFLDVDEPLD---TIGEYAELDV-DVKLSA------VGSIPE----------------HEEEDKIVAAVK---------------  1176
RLRaV     LKERFLAVMSSMREYVAKVMKSFFKEYFFLEFMDIEEPFT---TISEYAEYSC-EVDVNR------KGFLVE----------------DEEIKILSSKSQ---------------  1136
SCFaV     LEEKFKGALDAFNAYVTSVVKNMLTDGFGVHFMEIEDPFE---EVGEYHDLVV-NVDISP------SGEIVE----------------SEETSLIEAEVK---------------  1168
CTV       ISEKCRDLFLGIQDAVERCVKSYLRNSFNMSFVDLSDPLL---TISEYSELDV-PIDLPG------FGGIVD----------------GNETRLMEDGVKSAL------------  1496
BcLRaV-1  VSEKLRHMRFLFRSKFTTAIKRICKDAFDIDFLEATDLIT---SIGTHAEIVV-NVSLQR------SGSIPA----------------NEETNFIAAQAARLI------------  1240
CYLV      LKEKYRGLKQSFNDYLTTTLKGFFADVLLMEFLDLDDAFT---YYDNFSEITV-GIKQQG------FGAIDD----------------GEVQALLNSRC----------------   986
CNFV      LKELLARAKRSVREYMNKTLKGFFSDVLLLEFLDLDDSIS---DMEEYSEIRV-RVETNK------FGELID----------------NESEILVANKV----------------  1083
MV-1      ISEKIKDLKRNLNRTICDSFRKLFADALLMEFLDIDDSLE---YLDAFSETVV-HISLRG------FGSVPS----------------NEPEIMIADKS----------------  1066
TV-1      LNEKLKDVKRQFNKFVCDSFRKMFADALLMEFLDIDDSLE---YLDSFSEYSV-RIRVAG------FGAIPV----------------NEPEIMLAEKS----------------  1046
ReV-1     ISEKLKDIKRQMNKFVCDTFRKVFADSLLMEFLDIDDSLE---YLDVYSELTV-RIRTSG------FGAIPI----------------NEPEIMLADRS----------------  1043
BYV       FREWSRRAYAEINRSFRKLMKSILSAGLDYEFLDLDNSLQ---HLLEYSEVEV-RVSIAQ------NGEVDC----------------NEENRVLTEIIA---------------  1104
GLRaV-2   LREKIRNMTLNFNERLLQLVKRVAFATLDVSFLDLDSTLE---SITDFAECKV-AVELDE------LGCLRA----------------EAENEKIRNLAG---------------  1366
AV-1      IAENIKQIRELSSAYFTNMLKNLLSNVMDFSFIDVTNCLE---TVTEYVELEV-KVKVAG------FGCFDE----------------SSEIEVLRENLN---------------  1118
AcV-1     IHESTLTVKAAAYDVVKKILSSSFPFLGDLQSKSIDDFFT---VLGESITITR-AAKFPC------SGGYVN---GETRYI----D--NMVNTLLAEAVE---------------  1736
BVA       LKDKFKDSSKALSKRVLKFLKKHLKFLDVFDCMDLDEIYK---VCDKYTVLRITDSATTP------SSHLNV----------------KDEIAEIESYVDRAY------------  1232
PeVB      IKETVTSVGRSICEAVIKFLEFLFPVFKGLDSLELDKLYR---PIANFDYYEV-HVDIPTGNMEDSAGEIEAAAIKEFYY--------RNQKRFVKKTVREIEGVN---------  1449
ArPV-1    LKSVFSKFSQACYKKIIALLRWLLGNWVVEYADINDGKFF---DFNSSYVINE-QVIITNK---------------------------DEVQSSIVQAYEEALGRGKEFV---AH   907
CoV-1     LSKLFFKVKNYCYQYTLETMRYLFGDWVVEAYKSSGSQIR---YVSECIEVYQ-TIELNT------SGTFVD--ILDTTFERSVKDC-GDMADVLKDNFPEMKDDD---------  1203
LCV       IAYVLKKFSNWTHDFLMDVLKYLTPKSILSEVTSNQCSVYE--FIGEY-RFKQ-HVTIIGT---------------------------KSKRSILTESFEKFK--------KFSD   982
LIYV      IMHFLGGTKRFIYESLVDCLKFLTNSDYIDTIVNTESRIE---DLDKWFVFEQ-NVTITT-------------------------DA-EDQPSILEQSVKTFLSKYSEDVYERGD   929
GLRaV-1   VRKLCSSFFSGMNEYALTMLQALGSNLDVL----MDQNFRFVRTVPATVTLHL-VAETNP--------------------------CFTDRSMLLDEGLMAYR---------LHL   896
GLRaV-4   I----FSFPRRLISFIVSAIRRLLPSKIRKTF---DQLLDDPGLISDCADVIV----------TETSNDVSD---------------VVLKNEILEDVLNAVK------------  1021
          .                  .                                                                          :
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FiVA      ---------QRLETRK-----------LATVEKRERAKEIREWEEDKKNSSKAIEEKLPLLGSTNVKNNASNAYVPPH-R-------------------------SGTLLGGA--  1456
FiVB      ---------DRITLRK-----------ISRAEKEITQKEHREWIEDKKNSEVENTEDAPLLGN---KREKSNTYKPPHSR-------------------------GGGLRGGA--  1212
RLMV      ---------DAIVRDI-----------AVSAVEAQAPVRPKS-----------------------------EPYVVPPSKRE-------------------RP----GLFAAGSS  1218
RLRaV     ---------DSVIVDS-----------VSKIIGADQ----KG-----------------------------DKYVAPHMKK-------------------------KGLYGAGTG  1173
SCFaV     ---------NALLRDS-----------AAKYVAEETASEAK---------------------------------YVLPRFRNNARKGE-------------AKP--GEGLYAGSSS  1216
CTV       ---------------------------LRKAVQAEAQLSLKR-------------------GN--------TSEIVPCDDDDDSNGDDSRVSLDTDWWFVLRGGSSGGLRAGAAP  1557
BcLRaV-1  --------RNSLERDT-----------IVEVGDEVLLSRAAEEE----------------------KRESKKLNTASTSKSSSK---------------------KGGLAGAGVG  1293
CYLV      ------------SSDV-----------MNSAIVSSLP--------------------------------------PPKNKKSIAKNPTEGP-KDP----HGRE---RGLYAAGRR  1032
CNFV      ------------ERDL-----------ALQLFKEEVG----------------------------------KI------KYSHPNKSQPG---DS----KLRP----GLMGGSRD  1124
MV-1      ------------LNDT-----------VDSVVSEQVR----------------------------------KMYVPPHVKSRDGNNRPKG-----------------GLRAG---  1104
TV-1      ------------LNDT-----------VDALVVEQAN----------------------------------KIYCPPHARQSKREKPKSG-----------------GLNGGARR  1087
ReV-1     ------------TRDT-----------TDALIQERVR----------------------------------ELYNPPHVKRAVDGKQRSG-----------------GLYGGSNM  1084
BYV       ---------EAADRKS-----------IAQGLSGALSS------------------------------------------------------------VPTQP--RGGLRGGSRR  1137
GLRaV-2   ---------DSIAAKL-----------ASEIVVDIDSK-------------------------------------PPLRQMSNSSSEN----------VDKREIQRPGLRGGSRI  1414
AV-1      ---------QSALVQA-----------TAEVVNEVNGG-------------------------------------GPGAQKNNRKTRRG--------LLGSTP--AAGLRGGARP  1166
AcV-1     ---------NNARSEIVE---------ATSEVNNGNSKQGKD-----------------------------DKYVAP------------------------------GNRSGK--  1772
BVA       ---------KRDLGDC-----------ANSAFLDVMKL-------------------------------------ATVMRSGSGDGAPAGSNKGIE--------EEGGLGGGSSE  1282
PeVB      ------TILDSKITDPVKIKVQNGGVKIKSGVSNSTVLDALH--------------------------RAEEPYRGP---------------------------RGGGLYGGNKS  1505
ArPV-1    ADMEDLTDLTSETCDM----------------------------------------------------------------------------------------------GGGRM   928
CoV-1     --------------DL-----------VNEALFS----------------------------------------------------------------------------GGGKL  1217
LCV       KNYENLDMYTAERGDL-------FTPDIQQTLNDIFDL------------------------------------------------------------------------GGGVS  1018
LIYV      RSEFELEE-FSSEQDL-----------VDQLLNS---------------------------G------------------------------------------------GGSKE   957
GLRaV-1   RNGTNIKVAKDLVREAHKILRSMRA--AEKAKAESKGLEVDE-------------------------REITEDDILTFIQTKN---------------------LHVGLKGGVRS   963
GLRaV-4   ----DLTLLSAPEPEP-EI--------VEEPEREENSE---------------------------------EIEVSNSRKQKRGNSTDAHI-------------RREGLKGGANG  1077
                                                                                                                        ..

FiVA      -----SSLSARS--------------------------------------------------LLDMFSGYVR-KAIEVVYDFCGESMSKLM----------------------SK  1493
FiVB      -----SCINTFA--------------------------------------------------LLKLFSGYTR-KIFEVLYNFCCKSTGLSI----------------------SQ  1249
RLMV      --------SAFS---NFLQSPFTNVSDFFI---------------------RWAAAVAEGS--SKAATLFVA-FVRGILAKFSE-FLKVPR----------------------VF  1275
RLRaV     GW---A--SRLV---EFLASINYNPIAFFT---------------------EWVLSRLVGNPATQLIKKVVQ-SLSAVVKNTGD----VVN----------------------AF  1232
SCFaV     TG---SCFSKFF---DFLSSATTDLKEFIV---------------------SWASQYLGSN--MVGLSKLRE-LINTIIKVCGEAHLKTKE----------------------GF  1279
CTV       -----SLFRCLL----------------------------RKLG------G------------GLCLAKKVLELLVKRVVESFSRLKRKTARLTSFANLLLARLSCG--FFDDTVF  1620
BcLRaV-1  DS-----------------------------------------------------------------------VVRWVISSLSN--------------LIVK-------------  1310
CYLV      NDVLTSVIDMFL----ACRDILGN---------------------------------AAAD-ALSLLKGVFS-RILKEFGSFGS-----------------------------KL  1079
CNFV      DY---SSIRMLL---SYIKSFHSSSKAIFSCFCS-----------------ALIDNFIKFK-K--GVSKTLS-KLLAILNSFLK-----------------------------AV  1183
MV-1      -----SPVGVYEKVLNILRT-LSKN---FFCIGSSFAFHVR----------AIVSKIFPFE-RLPNLVKVID-LLVDQVSVF-------------------------------KP  1167
TV-1      -----SPLDVYE----GIRTALSK-----VCIVGSEVFKTKF--------FELLDLAFLGD-NFSTLRRVLK-FIKSLPDRL-------------------------------NV  1147
ReV-1     -----TSPQLFE----IVRTALGK-----VCLSSSTFYRQML--------LKLLDSVYGGK-AFSLLRRVFA-LIRSVSSYL-------------------------------ST  1144
BYV       SGV------------SFLYNLVEEVGNLFFSVGDAVRF------------------------LVKVFKTFSDSPIFRVVRMFLD-------------------------------  1185
GLRaV-2   GVVG-----------EFLHFVVSS--------------------------------------ALRIFKYATD---------------------------------------QQRI  1441
AV-1      NMLDWLRISLVA-VNSYLILPEHRSPKIFDLVSKN----------------------------LHIVKKFESSTTTEFVKFLLGRAQALLSRR---------I-------DSLQK  1236
AcV-1     --------------------------------------------------------------SSSVVREKIK-AVTGTMDRCDGSKPG-------------------------QG  1799
BVA       -----SMTTLVA--------------------------------------------------QLKALKYMGW-------------------------------------------  1299
PeVB      FSV-----------------------------------------------------------CEQVLKSLSK-VCTNAITNLSSLWPDYLSKFKLG------LE-G--LVLGKPL  1551
ArPV-1    KFYT--------------------------------DW------------------------DIRVLGQLFE----------------------------------HPL------   947
CoV-1     TK------------------------------------------------------------TNALYFLYIK-------------------------------------------  1229
LCV       TKL--------VKGHDFWQTPFSTY------------------------------------------------------------------------------------------  1035
LIYV      DEW----------FYSYIFSIVRT---------------------KC---------------TLSLAWRWTN-------------------------------------------   983
GLRaV-1   RII-----------NQGVKSYVNSAASTFTSSGNPASWAKSFAELKVAENGYTVGKIFSKSPANGVVKLPIAATVASLVMKDDG-------------GLGEKIEVGQPAWVSLLA  1054
GLRaV-4   NWY------------DFILPKKASAKTGSSILADLWRL------------VRKLDLAFRNSRVMGLVMKLLK-LILKVLKVVLGMLVADPQRFYPN-----KQE---------KL  1153

FiVA      ENFFRLGVNLAKIVGSV----------------------------------------VSLDLLVNLAKVVLSTTR-EDVLFLVNQVMK-AIAAL--------KLKGKRLASEMD-  1557
FiVB      RDFISYGEKLVKFVGSA----------------------------------------LAVNLVVALVKLLFLMTR-QNVCSLLQSFLD---IAL--------EIRTKVASASRDI  1312
RLMV      TSLWALFSKVWGVLVS---TKDSMKAAVV----------------------------SLLDLCSGLVSVFSS------SVGACRDFVS-SILGF---------VGSFVK------  1337
RLRaV     ALVWRACSDLVHVALAP--LPDAVNIK---------------------------------RFVSSSVDVIVKY----GGVGQIKDFFY-ASLSY---------LQSLYS------  1292
SCFaV     SMLWSLLSSAITIV------KDLTKEKYE----------------------------KFLSFCESFIKTINM------SVEKTRSFCL-AIFEF---------LGAICS------  1338
CTV       SAVWEIAINLTRIVDGVV------------------KTKLGCFRNLFR---------LIPKLYAGCKDVVKD------VSNAYRSVVSFSAEVL---------------------  1681
BcLRaV-1  ------------------------------------------------------------------------------TPGALKDCLR-NVAKL---------------------  1325
CYLV      RLLYDSTMSLAAVFSFP--PKKTAE--------------------------------LLLSAFSHFKLVGCS------F---ANSYMR-TVKEI---------LNGISAKGDRIL  1141
CNFV      KVDYETVNRALESLTHC--LASSYSIADTV-------------------------KVLLKDLYSNVKLTVKD------SHLLLQAFVN-AC------------------------  1240
MV-1      SAFFELVSRACAIFSEK--RAHASE--------------------------------FFYDYIVARIPVAPG------S---VKGFLT-SCANS---------AMSLSELGG---  1226
TV-1      KDALDLANEAIVYFTIK--RNKTAC--------------------------------FFYKLYSSFSTKVDG------C---TREFLT-SCADL---------SKRLVELGG---  1206
ReV-1     DELTNLIGKAIECFSAK--TRRTAC--------------------------------FFYELYLACSSKGVS------S---LGNFVT-LCSEL---------SSKLVAFGG---  1203
BYV       --LAEAASPFVSVVSLCA---------------------------------------WLREAVSAFSSWVADRT----VSESVKTFVNRTVKRF----LNFMSAKTLTKKFFR--  1249
GLRaV-2   KSYVRFLDSAVSFLDYNY----------------------ENLSFIMQ---------VLSKGYSCMFTFFANRGD---VSSRIRSAVC-AVKEV---------AASCASASVSKA  1512
AV-1      SELAGVVKKLITVVLSIVSLREVFSMPLYTGNSAFSKLK-GCFNHLLALSPDSMHNDLLFSCLSYCSSVKTD------VFQSCKTAFCRVISAVC---FPVGCVKSLGEKFLNCV  1341
AcV-1     AGLRDSGSSLFLMILRA-----------------------------------------------------------------VEGYVNLSVRSF------RDILLRIVSPF----  1839
BVA       ---------------------------------------------------------RFYSLLEKLVTLPFS------TFGEIRDYMIALIQNL---------------------  1330
PeVB      STLLDVISRLKGYFKNYN---------------------------------------ALLGGISRLVKVYKDSTGWDCIFFISKNVVAMASEVILEVVAGKPLFITLLKAGGK--  1625
ArPV-1    --FPPVAHNLTDIIYKIL-----------------------------------M----------------------------VSRVLTQMFKDL---NISKIFMKCC--------   986
CoV-1     ----------------------------------------------------------------------------------MVNFLCFKVKMF---------------------  1241
LCV       ----------------------------------------------------------------------------------MKLYLV--------------------------I  1042
LIYV      -------------------------------R--------------------------------------------------IFNFIT-SCRAK---------------------   995
GLRaV-1   SSLRALSERAAYVLRSKS--------------------------SLLMFGGGL----LLMASMLAFRRQILNRA--HGLAQGVRTSLK---------------------------  1110
GLRaV-4   SPLQSVAQSVKSILGSFL-------------EALVSFIDNSILGKVLGVIGE--AKECLVDNINDFSTNITNR-----TIDGLKTRIACGFKTI-GLKPPKGWLKD---------  1238

FiVA      RVYLLLA-DKVHQTLE--------SAKEKYI---VLKTKL----FQNFRHG------EWREIFCETSMIALSLGFFDYIKYL---RGEFS-----------LIHFNIRWLSKMIT  1636
FiVB      EVFVILALDLCRQKFS--------SAKEKVV---ELRDVI----FSKFNHG------EWKEVLVESISISVALVAFDYYRYI---VGEIS-----------LLELSIKWVAKAFT  1392
RLMV      ------------------------GIRREVV---KLFSNL----YDFCLQSED-----SFAPALECTVSLGIAIVTHLGVYL---SGSSS-----------GYVFFAKVSAQLVL  1402
RLRaV     ------------------------GASQRVL---HVVKNL----YEFCLQPSN-----G-AVIFEGVVSLVLSLFNHVPDLL---MGTIS-----------INYFLVKLVGQIIL  1356
SCFaV     ------------------------GIKVRYL---TVSSNL----FSFCLQNSD-----GKAVVFECLVSLFMA--NHGSDFL---FGKIS-----------LQFFILKCVSQIIL  1401
CTV       -----------------------GKSYSKLC---QFCLEI----FDIGLIEVS-----ARNLGLETCVSIALAIFDVLITFP---LGSVS-----------FPVVCARVFGRLAM  1747
BcLRaV-1  ------------------------LSSIEMV---PKFRKL----LSVILNPLIFDD--TVSVSVELLAKCFSKLLSAWGSYQ---QGGMS-----------FRAVLRDFTLSVVV  1393
CYLV      QILKSYVSAISSAAH---------KSHSRII---TEMKVA----LDALAEASYFDF--HEELPFEVAVSVIQKFVFDIPSML---TGKIS-----------PMQCVLRCATNLVF  1224
CNFV      ---------IAHKDS---------GKYKAFK---NKLSRG----YEFLFKWSNFDG--EIAVAFELFIVVFKRCAYDLSSFV---SGSIS-----------ANVFLTRIFSSVLL  1314
MV-1      -------------------------KFSLVF---QPLVKF----FDSFKHWSIFDG--SYVFCFESAAIVCKRLIFDIRKVL---EGRMT-----------WKSLLSRTLFDIVF  1293
TV-1      -------------------------SFKPRF---TPLSEC----FSVMKNWSFFDG--QQAIPFETCAIVLKRMIYDLKRLT---SGEIS-----------RSQFFNRVLFDILF  1273
ReV-1     -------------------------SFKLYF---EPLLEF----FKLVKDWSFFEG--QQALPFESFAIVLKRMIYDLKRYA---CGELT-----------KSQLFNRILFDMIF  1270
BYV       --FFLSASALAKTVV---------RKAKVIL---EAYWEV---WFESILSDS------GEYSAVEFCSSVVITLLTN--------SGRLLPG-------FSPSAIITEVLLDLAT  1326
GLRaV-2   KVMITFAAAVCAMMFNSCGFSGDGREYKSYV---HRYTQV---LFDTIFFED------SSYLPIEVLSSAICGAIVTLFS-----SGASV--S--------LNAFLLQITKGFSL  1600
AV-1      KVSLNFLNSCCNTTY---------RLSKKFL---RAMASV----FESVVFEFD-----ENYPLIEGLGMVVTNLIFTVLAGN---NPLKS-----------KRAFASSFVRRFFL  1421
AcV-1     ------------------------ERIRTVL---IPVLEL----WEKLFSG-------DADVWVTYGATVVYSVIRSIVYLF---LGHSTFG-----VCLGLVAVIATPIPPLFI  1908
BVA       -----------------------RRSSNSVV---NKLCKF----IDLFLSQGYIFDLNAREKAYVTVSSLATHLLTALICVV---TGTFSP---TKALFFTLQTFFGSSLVKMVL  1409
PeVB      --YFLAHWQVNRLTFDE--SSTGVDDSHEII---QLICDL---VWEGFCGRGLRVSI-PKALIFSIVRSLCAKHISTLMASKSIEAGRVS--------------------CNIVL  1709
ArPV-1    -----------------------KDTFNQIWSF-ISCADI-LAWFKNLY--------VMCKTNVKKLVLFINKCYTDLRQYIR--NLRIS-------------------------  1041
CoV-1     -------------------NVNNRHHIERILKFSSKILDF----FSIVYQVTIAD---PMWKVSNNLAIFFKKCVDAIRGGI---RGVTN------------------FIFDEVV  1309
LCV       NCWL--------------------KDEKRSVRYTNHICGI----WDYFKNFGLST--------IEFVKSILVELMTAIK------NGFTN-------------------------  1094
LIYV      -----------------------GKDFVKYI--------------------------------YEIIKIIINKPWEALCHYLV--QGYKT-------------------------  1028
GLRaV-1   ------------------------KTKGKLV---LGLSDLK-----------------------ERLGSVRRNAVVSA-------QGSVR-------------------------  1143
GLRaV-4   ------------------------SSVATLV-LEKVMSEL------------------KRAPLFPLAASVLITLVASKRIREKV-LGFTN---K-------VVCFIESI------  1293
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FiVA       FSVVGYQHSSLAGACESNLEWHFREMVAYVTANLV-IPTGY-GNVERLIVMSCAIPSIVRVL-LCSFMDEED-GTY----------------VGYVNHALSVNPIYSH-------  1724
FiVB       MGCVSHQLNHIGGESTTLLEWHFKQMVAYITASVV-LPSTA-TKIEKVITVSCAIPAIVRLL-LCSFLPEDDGGTY----------------VGYVNHGLSVNPVVSF-------  1481
RLMV       EYCANLFALTHFGKPELYSVEFFRRGVASLLAAVS-TRGVL-LDTMGVLTLSTVMPMLLRKV-LAFPF-VNY-SPH----------------AAYVLYAASDFPVYSY-------  1489
RLRaV      EYNIASYTHDRVGPPETNKSEFFRRCCAALAAAVS-TRGVK-FDCVGVVQLSTVLPMLTRKL-LACVL-VTD-NAH----------------INYVRHAGDDFPIFTY-------  1443
SCFaV      EYYANCFALECFGAPELYAQEFFRRGVSNFLACIS-TRGVI-LDTVGVVQLSTVAPMIVRRI-LGLVF-SET-SPH----------------LAYIKHAASDFPIQAY-------  1488
CTV        EVGSNFLFKKVFGKPETLGEDTFRRTVSMVLRPKA-FDKLS-VDAKGLVRCSGVIPGVLRII-LSSLF-SED-DAW----------------VGYSKHEVSSLPIVTFC------  1835
BcLRaV-1   DCTLSIAHNE---KPSTLLDSQMRCLLTDYISKAC-VFGVSPISLDGILTLSGVLVTVFRKV-VSRCL-DENTSTY----------------AGYYNNNAIDSPLIAYLRR----  1482
CYLV       ELNLNLAIARIIGPSDTLKKDMFNRTVSSLVSSAF-LDRFT-FSPETFIRLSTVVPMVVRKL-LVSFF-SDDFSYY----------------VGQVKYGVDDFSAFKYARR----  1315
CNFV       EINLNAFIAHYVGEGGQPKERIFHQNVVRYSLHLC-HDGFS-LDLFALLKLANVVPSVLRSF-LAEPF-NEEYDSY----------------FGRVKFGVKGFEG----------  1399
MV-1       EFSLNALLSCKLGPADTIKKDLFIRSVSSVVSDGV-LDGYD-MSVMSYVKLSALVPMLARKF-IVSFF-SDECDPY----------------VPLMRYAASDFSAYEYLALVFKN  1388
TV-1       EHSLNALIACKIGVADTLLKDMFIRTVSTLVADGV-LDGYD-LTLFSFVKLTALIPMFVRKL-IVAFF-DDECCEY----------------VAIVKHGVRDFSAAEYLYRIFVN  1368
ReV-1      EHSLNSLISLKIGVADTLLKDMFIRTVSSLVADGV-LDGYD-MTLFSFVKLTALIPMFVRKL-IVSFF-DDDLCEY----------------VGIVKHGVSDLSAAEYIARLFVH  1365
BYV        KISIEVLLKQISPADSTASSALYRRVLSEILSNFR-TMGEH-GIFTKVFLLCGFLPVFVRKC-VALCV-PGDMATY----------------ARFLEYGVDDLFFLGR-------  1414
GLRaV-2    EVVVRNVVRVTHGLSTTATDGVIRGVFSQIMSHLL-VGSTG-NVAYQLAFIAGVVPLLVKKC-VSLIF-IMREDTY----------------SGFIKHGISEFSFLSS-------  1688
AV-1       ELVAILHTRVDE--NSTGTEELYRRCCASIFSNLC-HRGNG-GL-YDVLCLSGVVPMVSRKI-LSLIRGEKNISLY----------------TGFLSYSASDFLVLEQ-------  1507
AcV-1      TDKDN------------LSADILFEALKGAYFSVPLTRNKWLNRVLSVLENVGYFKSLVRRI-IAVVF-EESTAAS---------------------------------------  1970
BVA        GSNLNFSRFRASDDFNAFIDTFF--LVTDALILWP-SSGVV-SVAYGVCTALGMTRWMVRKA-LLPVV-GADSGFHGLMVCSDSPDCNIVRLIHFVKYVVSALTEFAC-------  1511
PeVB       DEFVN------------VIRRIIRKTCDFLKEELV-------KFACDIIDKPDIKGRITRLV------------------------------DAYLSERVSSTRDVVY-------  1768
ArPV-1     ---------------------TFQTFFSKVESQMDEIDEMD----------------------------SIDLAEFG-------------KWLVLNHHDFDEFKSLSFDEQ----  1090
CoV-1      SRGFTLFKNTLKQCRDYILDTIMRVGLKVIMSRFDPISELD--------ECVNILDDVKVNS----------------------------NEKTTVINNMDDFDDITH-------  1381
LCV        -------------------------------------------------LSSCVVSNLQRAA-----------------------------------------------------  1107
LIYV       ------------------------------------VLKIP-------MTCVDSVNYLKRKS-LEKIL-----------------------------------------------  1052
GLRaV-1    -------------SLKVVARAEFKDRVSGYVEEMGYIYGDSLNVQTVCLTAAAYLSSSYEKSAILILL-APKRFRY----------------IGSVGYGIAALRCIKGGEY----  1224
GLRaV-4    ----------------KIKRPIF----------------------ICSIILGAVMKNLARLS-FLMMP-VEDCREV----------C-----IGMMFSNILNCAYNTYREPT---  1350

FiVA       -------------------LAYKARHFGLSIKEYIRRCVS---------------DVSSRVGESLLNSVSDASG--------------------------------------ITA  1767
FiVB       -------------------LTLKAKQYGLSVKAYIRDVVD---------------KVCGCVGEALVTSVKDATG--------------------------------------VTH  1524
RLMV       ----------------LSCAVASGVLSLDSVVSLVTASINEAFD-----------GIVTSKMKGCKTALKECTVS---RVVARF-----------C--NGLTTP--------FSA  1553
RLRaV      ----------------LSDLFSSVRHLPNELCTYICAQVGDYINH---------LGLSDRSDLSMTSYIASKCVK---RIFSTF-----------C--KAQVTPAGQSTVELVTS  1517
SCFaV      ----------------LKCLYDSHVFTRESLELYVTDLCKSLVS-----------SVLSKDVLGVKTLIKDNMVT---RVFSRLHPRSYFIPKVECAVSSALSS--------LKA  1565
CTV        ----------------VKRLSYSLERCKEACVAFIVDSAKKILK-----------SLTSEFNESIQNSDLTSGAKSL---------------------YGHVSS--------ILY  1894
BcLRaV-1   ------------------ECLRLGVGIGEYLKCLIRDTISEMVSA------QNMKEYGKKCCSDISGKVKEGTE--------------W--------------------------  1533
CYLV       ----------------------NASDAYHSILNSLCRSSESYLD-----------KVIDKFVETVKSTLLETLP--------------------------------------GKE  1359
CNFV       ----------------IVALKEFAADSVDDAIKAIGDRFEKFFV-----------NLVSRCAAHFIEKFMEETD--------------------------------------VNK  1449
MV-1       EVQGHVELIRDSVTDCLRAVGGKAAARTEAVLDLVEQRLELISR-----------RMVKNSIDEVTKRLSDVAA--------------------------------------CKR  1454
TV-1       NLQGHVLHCKEWLQSVLPTLQSRSGECVEAAVQRLEGYMTLKLK-----------QVAEASASEMNNLICNNRI--------------------------------------VKC  1434
ReV-1      NVQGHFMHCKEWIIDLISTIRERTDESLNHLLARVDEYISERVS-----------AAVSKTLDGLRGRVTDNTV--------------------------------------FKT  1431
BYV        -----------SVNSIKNYLCVVAAGLVDSIVDSVVLKLSGVAK-------ERVLGFKSKIIKNFLNVFRKAKV--------------------------------------VTR  1473
GLRaV-2    ---------------VLTFLKGKLVDELKSVIQGVFESNKHVFK-------EATQEAIRTTVMQVPVAVVDALK---------------------CA---------------AGR  1745
AV-1       ------------------TLRKASTRFHNAVDLYLSEKFSSIMTV-----------INRTYMGKFAVGCSELSK---------------------RA---------------CSA  1557
AcV-1      ----------------VVMLVVRPEENVWAVENLVKKAYDWAYD----QIYTTLYALLSAVPHSAKAAVANTIGDV----------------------AGGVSSV---LTTSVAK  2040
BVA        ------SQVDAAMLAFRSTVSAGVADAQAAAKLCAMNQVDDILNSMR-TCRDRALEIPKNASTTLCNNLSDVCA---------------------SA------------MERVSR  1586
PeVB       ---------------------------------------------------SSLGNIKSSCGSKIKSFFKTPDV--------------------------------------IAR  1794
ArPV-1     ------------------------------------------------SMLISTFKLISE--------------------------------------------------GQVGV  1107
CoV-1      ----------------------------------ILNDIDELMTSGGGRRNIKVFQLIQETLKFFRDCLLKSLTKFA-KALAKY---VYL-----C----------------VKA  1437
LCV        ---------------------------------------------------RTMYNLTKR-------------------------RNSDWE-------------------DQLSK  1127
LIYV       ---------------------------------------------------------------------------------------SYFS------------------------  1056
GLRaV-1    ------------------------------------------------GRASKLMGVAACLALTAKKGASRAASLQI--VFPK---------------RGDVYEG-------VTS  1267
GLRaV-4    ----------------------------------VLNKVEVLSNF---LLLQRNMGIMSSVFALQKRVVDEPTVKDVADVDPKL---SHF--EI----NSDVEEV-------INN  1412

FiVA       VSNAMVDFKTKAKEF--------------LPKMLISK---LPFF----------------------------SEAR--------NFG---KNDKAADEEI---------------  1811
FiVB       ISHAVSYVKGK----------------------LWNA---LPNF----------------------------IAAS--------HDD---SKDEDVNEE----------------  1559
RLMV       TSAKFRDLASGVPSFN-----VTSIR-----KSVRDR----------------------TARHFARILSQP-AIS-----------------DEAPL-ELVDFP-----------  1606
RLRaV      AESCIESLGSAVP--------LDEIA-----KIAEDE----------------------VGDGLSPV-SQP-VNG-----------------ESATS-E----------------  1561
SCFaV      IEEKVVAKTSGVYSFA-----ADNISA-QYLKVANNRGFSKHKFSNTAVVVAEDEDDCHTAPEIQRMHSG----S-----------------DSELS-EISTFPE----------  1642
CTV        TSSGVINKAGSAV---------------ATVKAVGSD----------------------ISGRVKRMRPRF-SLSR--------HF------DEQTS-E----------------  1940
BcLRaV-1   ------------------------------------------------------------------------LTSY--------FKG---KFRVGNE-E----------------  1548
CYLV       MYSSLLSLKGGV-------------------HARYQS----------------------LKKRLTRARRP--QTS-----------------SDDEE-D----------------  1397
CNFV       VTACYTRKKQRA-------------------ESLYAK----------------------LRKCLSDLFSRGDNGG-----------------DDGGD-E----------------  1489
MV-1       ISSSCSSISGAV-------------------IATSNR----------------------ASRFVKRVMNR--RCS-----------------DPGTD-V----------------  1492
TV-1       ASNSYGAVTGGL-------------------TKMYKA----------------------ARKRCDY--------------------------DDEAS-D----------------  1465
ReV-1      TANSYRKVSRVV-------------------KKVYGF----------------------SKHFSAL--------------------------DGDSD-V----------------  1462
BYV        TSSS----------------------------------------------------------------------------------------TDLSEDE----------------  1484
GLRaV-2    VYNSFASRRTFGKDNG--------------------------------------------------------SSS-----------------EDACE-E----------------  1770
AV-1       VNNVIPSMLKKP------------------------------------------------------------QEG-----------------DDGDE-V----------------  1578
AcV-1      VLDWFSNQRQNPPGLG----------------------------------------------------------------------------QDGGTEE----------------  2063
BVA        VSNWVASNSFQSSDIE-----VVDLVGTGDVVDVYQP---------------------PTPAEMAVLHSII---------------------NEDLD-SLDD-------------  1640
PeVB       YFSSIDEGTSGEVDVN------NECADNPESTVQEDA-------------------DVNFDDALSTLYSMS----------------ELE--LEGSGLEAVEMQ-----------  1855
ArPV-1     AQDDEDTFEDIPLD------------------------------------------------------------------------------DDRKSVNIIDSNHP---------  1135
CoV-1      AVASLTSFLKSPFD---------RLSDLKNVINVEDEL----------------------------------RFSLK---------------DDSSDES----------------  1478
LCV        MLDDTDKLYGSTLR------------------------------------------------------------------------------EDTKKPD----------V-----  1149
LIYV       --------------------------------------------------------------------------------------------HERADDE----------------  1063
GLRaV-1    FYRQRAERKGAAIEPS-------RRSEGEAMDDILDE--------------ATCGTSSEVEQEKEDLTSKT-EDS-----------------TDASDDESVESSQ----------  1333
GLRaV-4    FRSNIKDLKNAKLEKRPVKFEVGESSGSKKAETAKPK--------------------VATADKRRKESSKR-STGDCGIVINDEHISETR--AEATLKEKEKKAEPVVKVSKACN  1504

FiVA       ---------------------FYDA-SDV-----------------------------P---GLKGGNRRL------------------------------LLTTARRWCLAL--  1840
FiVB       ---------------------FYDSTSSC-----------------------------E---GLKGGSKTFSA---------------------------NYVVSKIRYLFS---  1591
RLMV       -----ATEEILEDSLFESAPSSFSGEDDRVS-----LLSR-IR-SF--PFFSRGSSKKP---GLFAGSKSSRV----LEFLYHFFSTLREIPL-SLQSLWYFLVGRVKSVFSDC-  1698
RLRaV      ------------------------------S-----LLKRLLR-RFVVSGF-SLYRTRP---GLGGGSRCSNA---IVRFLNYISGLVQR-------------------VFSA--  1612
SCFaV      ----GCEEEVFHDFI----------EDGQLS-----LLNS-FK-SYLLQYFVSTERKTP---GLGGGSRRRGVMNLLMRYLNYFLDCVSSIDIRGVQSSLYLAVKDV--IFTN--  1729
CTV        ---------------------YYSASDCS-------ELDE------------SLFSETP---GLRGNARC---------------------------------------------  1967
BcLRaV-1   ---------------------FFDATEED--------LDS-----------GESTSVKG---GLGGGSRCKSIIS-------------------------------VVTLFFGLK  1589
CYLV       ---------------------FFSTSEDS-----------------------ELLSEKP---GLFGNGPR---------------------------------------------  1420
CNFV       ---------------------FH----DS------------------------ISSFEP---GLRGGSAE---------------------------------------------  1507
MV-1       ---------------------YYSAASDSND---------------------ESTSAKG---GLAGGNSCR--------------------------------------------  1518
TV-1       ---------------------YYSADGGS------------------------EAETSG---KLRGGARKE--------------------------------------------  1488
ReV-1      ---------------------YYSADSDC------------------------ESSYRG---GLRGGGIPS--------------------------------------------  1485
BYV        ---------------------YFSCDESK-----------------------------P---GLRGGSSRFTLSR-------------------------------LLDIFFN--  1513
GLRaV-2    ---------------------YFSCDEGD---G-------------------------P---GLKGGSSYG---------------------F----------------------  1790
AV-1       ---------------------YFDASEN------------------------------PERGGLKGGSPRN------------------------------YSIVHVYSLISNFV  1612
AcV-1      ---------------------FFSMVDDV------ESIDDL-------------LSETP---GLRGGGVLNRNFL----------------------------------------  2095
BVA        ---------------------YKSACDGY--------------------------SDTP---GLGGGNLAVHASF-------------------------------LASLFSVGS  1674
PeVB       -----AELETVRRFI----DEYQSAFDSV-------ALDLLKEEGY---GSELELSDKP---GLMGGGN----------------------------------------------  1902
ArPV-1     -----TSIFVIRTNS-QLYNKFKLSAEDM------EIIQS---------------TVES------GGGHKRTNFR---KCLQ------------IINADIYLLTNSVIVFFGNKF  1202
CoV-1      ---------------------STSDDESQQS---EGILTRHER----LCIFLATEKLEP------SGSRLLRMLR---KFLSI-----------------------ARKFLPNCF  1533
LCV        ---------------------KYEHIETM-------SLDQLFD------------------IGNEGGSGKLGSFI---------------------YNHNNVLVRKVNQYYYGTK  1197
LIYV       --------------------YIFPGYDSD---F----------------------SEES---GDYGDENTELDSR----------------------------------------  1090
GLRaV-1    ---HTAQSHFV----------TTSVNESKHE---SGILAD--------GKVESRKEEEP--------------------------------------------------------  1368
GLRaV-4    TEEPAAQTEPTRIPT----PSYIELDEERNAIFSEENLEATVD---------DVLSDAE---GKKTGDTRMKA------------------------------------------  1561
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FiVA        -----------------------NSLLKGVKTK-------VNMW-KVE----NEKRSLYNEVMRE---------LNYIVDEGK-TSSFA----------------LTKFMNIFQN  1894
FiVB        ------------------------SKFQEIKNN-------VNIW-FLE----RERLRLRNEVLRE---------INYLTTNGS-FSSYE----------------LTKFVNNFQV  1644
RLMV        --------GGLMSSILCCINSGIDSVLLCSLPD-------VSCL-FSDSPN--LRGGLRGGNAGD---------FWFRYSVLQ-DFAL------------------RYIFNSHTL  1767
RLRaV       ---------DLVTKALESVRAFISSVA----P---------RAL-LSL-------GALS--VSVS---------VGFVFPNLV-PVPL-----------------FLNLFTGSHL  1668
SCFaV       ----------LPKYCLAVLSYNLIPLMKCSFP----------VL-FDR-------------NLVN---------EAFMYSHL--------------------------IHNCAEL  1775
CTV         -----------------------RDLFRIVSRRAVACCEYVTIL-LKRLAS----------------R-AGEYSYSYVMDTLV--------------------------------  2009
BcLRaV-1    -------ACALFKDYPEMERSLLRLARHAEFSKRLD--LTVMIERFLRCCS-KWRGKKYTNIVLSV-----GSSLYYLLKFTA-KATAGGVWDLTVWVARCADQVSRLVANCGII  1688
CYLV        -----------VQGVISCGVGFVRDLLRSFRRL-------LSTL-FIRCS--------------------------------------------------------RHFVANFNL  1460
CNFV        -----------VDFVITCV-------------E-------VYVM-YVTC------------------------------------------------------------------  1524
MV-1        ----------SFVGVITALLALLRGLGKFAYDE-------VYFL-IV-----------------------------------------------------------NQLLRPLNL  1556
TV-1        ----------ILSSFLAWISKVIRSLYRYSIKE-------VKYF--V-----------------------------------------------------------DTQILSHTV  1525
ReV-1       ----------VLSSVIRISGAAMRVVWRFLVRE-------VKYL--M-----------------------------------------------------------GTIVQDFSL  1522
BYV         ----------FLKSSKLVIENACFSAYERIERN-------MKLY-FFPLNSSEEEARRLIRCAGD---------FDYLSDSAF--------------------------------  1569
GLRaV-2     -------------SVLAFFSRIIWGARRFIAKMKHEC--FGKLFDFLSLRLHEFRTRVFGKNRADVGV------YDFLPTDIV--------------------ETLSSIEECDQI  1864
AV-1        --------SRLVKQSLSMKGKLFQAVQRVVKKF-------SSMLNFVK--------------------------YQFGVDDVS-ESG-------------------SSVVSATTS  1666
AcV-1       --------NSLIMKFLDMGRTLVDSV--------------VSSISYIKSKL----------------------------------------------------------------  2124
BVA         KWKDLCLFIDMIKSSGSMVAKTLNKLVKVVVKKLID---------FFTVDN-EPDDSQIEEVGVD---------YSSRAVDIK-DSCIRALENL-----------PTNEFGSSSN  1758
PeVB        ----------------------------------------VYMF------------------------------------------------------P----------------  1907
ArPV-1      K---------VLKTFFREGYLVIRDLFRFSDEN-------LIRSTFYSLPEVYSNDHS----------LFKWYSMRHIYKNII-NSSITIFINL-------SNV-FKTYVKFLAD  1282
CoV-1       M-------------------KTIEEILALVETN-------LIILRFEKSELQNGIDKSHCKIVLYLLKLKNAVVMMFKTGKVCFETLFIVFNKL-------VNILFRNFVKYFSK  1615
LCV         ----------------AMVQWIVESIFKFVEWT---------------------------------------------------KTSYQS---------------LKAFVKYTVE  1230
LIYV        ---SRC----------TVIKSKVEMLFRNIKGH-------IEKF-LQRCGI--------------------------------------------------IDQ-YNKIYHWFKS  1133
GLRaV-1     -------------------RRIVDKGKKVVDYD-----EELNMR-KEKCRL----------------------------------------------------------------  1394
GLRaV-4     ---D------------------------------------ISQL-----------------------------------------------------------------------  1566

FiVA        DERIVDAVRARIGSGYN------------------EEEI------------RGYVDCAAVV--MFVRLRRL------------------HSSSIYSKIV----------------  1943
FiVB        DEQVMHAVKELFGDETT------------------SLDV------------RELADAAAVI--VYLVAKR-------------------RNNSWYNRII----------------  1692
RLMV        SY-VTNCFTFIID-----RAPSFLLS---------GRDVVLRVISCIFPHISGAFNHS--LYGVLPGLRGG------------------SSLSLS-------------------R  1828
RLRaV       AY------TLIR---------SNILK---------SADLCRRF-----------------------ERRLG------------------ASLSLRSEIDIVLDASVDEANVRLPR  1718
SCFaV       AYRISNT--------------EWYLR---------AEDAIRRC--C--------------------GFETR------------------SSMEHK-------------------R  1808
CTV         ---------------------RLYVA---------TDDVVRRCRS--FT--FDCTDKASNFVTGFLSWRSLRSGAYSATPGLGGGSRGLTSFSHTGGFT---------------R  2075
BcLRaV-1    PKPIRKVFKGVVDV----VRSSVYMCRLVVCNPEASGNILLAKV-------SGIDGQS-----LLAQYSKT------------------ISLGLKACYF------------KDSR  1757
CYLV        NLLSEYSRTIRLEYEDHYLKNTYYLHR-------LSEDVVQSF--------------------QLERSRSQ------------------LRVP----------------------  1508
CNFV        --LTQTQVSLVIELQ-----------------------------------------------------RSL------------------KRSPRPSSTT----------------  1550
MV-1        AEFISTLKEFKID---------------------------------------------------RLRRRNL------------------NRIPVTFSAR----------------  1586
TV-1        QSMIDSLRCIREE---------------------------------------------------FQKRRSL------------------NSMPVIGSVE----------------  1555
ReV-1       STMISSLYEIRRE---------------------------------------------------LLRCRAL------------------REVPIIGAVE----------------  1552
BYV         ----------------------------D------EDEMLRQAFEQ----YYSSDDESVTYDGKPTVLRSY------------------LNVSRRFLET----------------  1612
GLRaV-2     EELLGDDLNGVKDDSLT-----------DMSYFEFSEDFLASVEEP-----------------PFAGLRGGS-----------------KNVT----------------------  1912
AV-1        VASSENSVDH-------------------------GDQC------------------------------SL------------------ALVPHRYLFEPVVVP-----------  1697
AcV-1       -------------------------------------------------------------------------------------------------------------------  2124
BVA         RFIYLNFIRSRRE----------------------SRRII-----------CSERDARLILQEIVCVRRIQ------------------LGLPLHCDVF------TDLSFVQLVD  1816
PeVB        ------------------VLSKHSML-------------------------------------VLERIRNY------------------LRLPLKFMLE----------------  1933
ArPV-1      KEVVQQIFDEVSLLKT--SFCSTSLQM--------------------------------IMTGTLN-LRTI--------------------------------------------  1318
CoV-1       PELKQILFNNTFELAIT-GVSAISLA---------------------------------VLGFNINVVRII--------------------------------------------  1652
LCV         KMLETDNLTMIIDSAAF-TFTNLLMA---------------------------------VMTGDLNLIRVF--------------------------------------------  1267
LIYV        ILTDVDCFNSVLNFITH-TGCDALLA---------------------------------VLTGHFSIASCA--------------------------------------------  1170
GLRaV-1     ---------------------------------------------------------------IIEKRREE---------------HG---------------------------  1404
GLRaV-4     ------------------SEAEIDLL--------------------------------------VENFNSE--------------------------------------------  1581

FiVA        -----------------------------------------EFFAALGSN------------------------------------------VR---------------------  1954
FiVB        -----------------------------------------NFFSKCG---------------------------------------------R---------------------  1700
RLMV        VLCTIFPVVGITIADV--------------------------FF--------------------------------------------TALTYSFH-DAIVYFICGVGYLSGGIF  1872
RLRaV       LLAAHWPEYPGFVPECDIISVSDYDDNLTDDCDDDEVLCHSSFWSQLSVITLKGLS-------------------------------CLTLALR------VVFATGVVSCVAYTP  1796
SCFaV       RVSAYVEAMPGIIA---------------------------------------------------------------------------ALANR-----------GVLNLSGNIP  1837
CTV         VIGALGNTLSVVFDEEFF-------RTLLHRLRADVVVLLVEFLKNLP-------------------------------VCL--FSIYTFIECRGR-------------------  2131
BcLRaV-1    WIGTYVDINP------------------KERCNGG---VYYDFQSDISETEIANVADFEEHVMGFDLHDDE------NLACL--TPLNIEVLTRDE--------------FAKKM  1829
CYLV        -------------------------------------------------------------------------------------------------------------------  1508
CNFV        -----------------------------------------KF------------------------------------------------------------------------  1552
MV-1        -----------------------------------------QFG--------------------------------------------QLVFVR---------------------  1595
TV-1        -----------------------------------------NFG--------------------------------------------RLLRAK---------------------  1564
ReV-1       -----------------------------------------NFG--------------------------------------------AMLWAR---------------------  1561
BYV         -----------------F-------------CNGP------KFFVKV-------------------------------------SNYFKALYSR-----LLRVLPWVDRNLSDSP  1649
GLRaV-2     ------------------------------------ILAILEYV----------------------------------------YNLFRIVANK---------------------  1930
AV-1        -----------------------------------------SY------------------------------------------------------------------------  1699
AcV-1       ------------------------------------------Y-----------------------------------------------------------------------P  2126
BVA         IFNSVVGDEPNILDRLTF-----------------------AFY--------------QYHAL--DCVREPWSVALCNLLCRLGSSFTTSYYNR-QIGLIGYNSDRVIQLTTPPP  1891
PeVB        ------------------------------------VCKKLYYF-----------------------------------VCR-----FQVRQKRKE--------------YIEDP  1958
ArPV-1      ------------------------------------CFFPVAY------------------------------------------SIARYIGHK---------------------  1334
CoV-1       ------------------------------------AIPPVYFLTKRAFA-----------------------------------------------------------------  1666
LCV         ----------------------------VSSC----LSAYLRF-------------------------------------------------SK---------------------  1280
LIYV        ----------------------------------------LKFMTDV--------------------------------------VIEKNLSEK---------------------  1186
GLRaV-1     ------------------------------------GLIPVVF---------------------------------------------------------------------KEP  1414
GLRaV-4     -----------------------------------------IF------------------------------------------------------------------------  1583

FiVA        ----------------------------------------RNFE----------SVSQMVIEKY----------HKFAELASQ-----------------KRVRSNAELEHEK--  1990
FiVB        ----------------------------------------R--------------VAALVL--------------KCVQIA-----------------------ANYLRKYTR--  1722
RLMV        SA-----------------FTLC------------HLL--RFLFRTDWTPL---SKVANSLE--------------------------------------DRCRSFLS-------  1908
RLRaV       SAIGAT------------IYGVCGPIVGGLVLGCFHDL--NQLSPHSLISLTLTSLYCNLFESV------------FFYPKIA----------------LNRVKV----------  1859
SCFaV       S---------------------------------------------DIVALLDNAQQSNPNE--------------------------------------DNLSG----------  1859
CTV         ----------IFPL-REFLWGFCR-------------------------------FVWDVIE-----GLSINTYQYLSAVAEKVYRGAF----------NRRFNEEDERTLRV--  2187
BcLRaV-1    GLFGGGG-------------------------------GC--------------SFISELLKVFASAGLSFVKTQAVTSILSILCESSCTLVGCSSLVLIYRVASKADAVLRL--  1897
CYLV        -------------------------------------------------REVLRTGVCSTVKWV------------VSDLMFFI---------------RRRLTSKSFLYYDL--  1545
CNFV        --------------------------------------------------------------LP------------FSEVLNM-----------------RRCVST---LFEL--  1571
MV-1        ------------------ATEHCH----------------------TVKSVIDRVGVAGMFKVA------------FLDFM-------------------DRFGSVEYLLFEL--  1637
TV-1        ------------------CIRYTP----------------------SLLSTYEDSGFFGIVRIC------------TKRVL-------------------RDIDSFEFLILEL--  1606
ReV-1       ------------------VFAFGM----------------------VIGPTYSASGVTGVLRVC------------LGRVA-------------------EDCRSSEFLFFEL--  1603
BYV         GLKGGNEKALLAKFFKTCVITACE---------C-----VSQICCLRLIRLCWGTPACGLVRLF---YITYSSTRVLSRVVVAVAVCPL--------LVRNELDGLSDGLTNMGV  1739
GLRaV-2     ----------------------CS---------------------KGPLLVAFAELSSALIERF---KGKFSRKNKIFTIVREYALSSLRCR-------MRALGLNNDFVVNSFA  1992
AV-1        SVVGSDDEIEEEA-------------------------------------------SAEVIEVF----------------------------------------GDDDSFFD-PR  1730
AcV-1       GSLGRTKKGGE--------------------------------------------------------------------------------------------------------  2137
BVA         GLSGGCS--------SDELISDCR----------------RVM---RFKLLRLKLYVSKMLCWGT---NWICGLATYISVVRGVAGSAY----------HRRISVFGDELY--FD  1964
PeVB        GT-------------------------------------------DTWVPL----------------QCSVDCKGAVLKMEEGVFGMLA--------------------------  1988
ArPV-1      --------------------------------------------------------------------SSYSKSSPITDILTSAI------------------------------  1351
CoV-1       ------------------WFYKTE-------------------------------------------------EPPIPMIYTTMMGA----------------------------  1686
LCV         ------------------------------------------------------------------TGVKWFGSNAVGDAVSTLITNPG--------------------------  1303
LIYV        -------------------------------------------------------------------------HHTTTKLIAGNLTQCI--------------------------  1202
GLRaV-1     KCEGKDDESEEES--------------------------EGYL------------------------------------------------------------------------  1431
GLRaV-4     ---GAEDKE---------------------------------------------------------KENTTAKSESISETDSEDSES----------------------------  1610
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FiVA      ---PLLCEEREGTSAVEPMDIV---------------------------------------------------------------------------------------------  2009
FiVB      ---TAPCVNKCDENAISPIPQVLHSDECF--------------------------------------------------------------------------------------  1748
RLMV      --------FPPRSHSSSP-------------------DCQTDEERALRDLLV-SIADLYT---------------------------------------PSRDAAR---------  1947
RLRaV     ------------LCGCSP-------------------DPIYRDDVVAALLLN-KIRQLTAE-------------RDGVNT-------------------P--DGGEVPV------  1902
SCFaV     ------------ENSSTPEG--------------SDWDFEYVQHRLAEGSTF-VAEDVFSA-------------NLGFNA-------------------PLNNTSEIV-------  1908
CTV       --------ITEAEGRIEFLRVVLAEMERF---------------------------------------------RAASNEVSS---------------SRSSDSPSFP------P  2228
BcLRaV-1  --------------------------ARF---LRSEREIIKTCDYLLLFNNRFGFKFIETQ-------------LLRLRE-------------------KAKTISECKGFKLIVR  1951
CYLV      ----PHVILAFYTLPQSPLFFSLQL-------------GTYVCELLHSDDVKLFLKTTYTR-------------VGLSNT-------------------TSVTLYP---------  1602
CNFV      ----PLTALVICGVFSSPTTAMVETLTPL---CLASFE---------------YVVNSFRA-------------EGSVGS-------------------DDSDL-----------  1621
MV-1      ----PIYLAELYMYYNHPLTFSVRVVSYL---ISFTFQPVYTCDIIT----------TVAN-------------GVVVNT-------------------ER--------------  1689
TV-1      ----PLYCFELYTHFDHPVTLGIKILWRM---VEFTYVDFFACELSSLDQAP---AEVFAR-------------VEEIEN-------------------DQ--------------  1665
ReV-1     ----PLYLLDFYLHSGHPLTIALKIISKM---IVFSFGESYACELMVVGKAR---PDVFVH-------------IDEVNT-------------------PS--------------  1662
BYV       S----------------------------------------------------VFRRLFVAL------------RRALSAYSNSALRRKIIEFIFGNIHHPFDVAVIETN-----  1785
GLRaV-2   D---LLPMLVKRKVSNSFLSSVYRPIKSF---SYMCASAERREKFLALVCLVGLSLPFFVR-------------IVGAKACE---------------------------------  2055
AV-1      SGRP------TRRHSRSQLDADAADMENF------------------------------VR-------------TFGFSS-----------------------------------  1761
AcV-1     -----------------------------------------------------LLAELFSER------NCED---------------------------EEYDAAVLYLN-----  2161
BVA       GAEVRNYVVDLRDRGADKLEVVTAIIQAVFDDIETFGNTQCTAKVLLSGRRAVKIKRFFLRHL--LAFFVEWHSIISVEE-------------------DPND-----------R  2047
PeVB      --------------SDLPLLILPPGLDAM------------------------RIEKWYYA-----PFTCWDSRDLMADQVH-----------------EQRDSSGTASS--LCL  2041
ArPV-1    ----------TTGSALSPNNLMLAGANSL------------------------IVKTRWMK-------------FATSSEWFA--------------------------------  1387
CoV-1     ------------GLSTSLPSALISAATVM------------------------VCKSRMVE-------SCGRM------------------------------------------  1716
LCV       ----------FNGIVTAPIVLVGSRV---------------------------FAKETKLR-------CAS--------------------------------------------  1330
LIYV      ------YKLDFIHPIWIPIRWGVKEISKI------------------------HIKKKLLN------------------------------------------------------  1233
GLRaV-1   -----------------------------------------------------CLSSTKVERGDASPSGCKSADCKSISEES----------------PERKTKSSAIIED----  1473
GLRaV-4   -----------------------------------------------------EHETVFVE-----EPTCET--------------------------DTTSDSSEQPIE-----  1636

FiVA      -------DVYDDYFRTY------------------SIDLTTFENVEIRGGLCGGGK--------------LVTLRSAFDAF-LRCVSSI------------------RANFRDCV  2066
FiVB      --SISEIEISNDFVETLEV---------------CSVDPDTFEITIEKGGLKGGGNDFFKSLAIDLIHFILSGVRIGADVW-HSAVASI------------------RS----LK  1823
RLMV      ---------ARLP-DS---------------------EHDS------------------------------D-SEILSDF----DCFDVPT--VDGSVTLCDPLPRPED-FSDLE  1993
RLRaV     ---GLG-EMAEIA-EE-------------------------------------------------------------------------------GTIGMSE-----ED-FTDLE  1927
SCFaV     -------ELIEDP-ESL------------------GLENDW------------------------------N-IGALSDE----DL---------------------GE-FSDLE  1940
CTV       TYGEIE-ELNDDSSDSALV---------------IGVDNGT--------------------------------GRTIVDGE-------------------TD-----SASGSDSD  2271
BcLRaV-1  PLATVV-DISDEVARVFLSVPLVLYRLLSSIATRSSRRNNS--------GKRG------------------D-APSLSEEF--------------------E--------FSDDD  2010
CYLV      -LSHVE-PVLEDSPLS---------------------ETES------------------------------D-ESETNDLFRQSTIAEI------------------EN-LSDEN  1644
CNFV      --DINE-DFCLDA-EE---------------------CSDS------------------------------D----IGDL-----------------------------------  1642
MV-1      --SVVE-EIVPD--EY---------------------DSDS------------------------------DFSMGLGEV----------------------------D-YGNER  1719
TV-1      --SQTN-DEIEE--ES---------------------ESDS------------------------------D-EESLRGL----------------------------S-YSESR  1694
ReV-1     --ARSE-QEIEE--LL---------------------DDDF------------------------------G-SRSFPDL----------------------------S-YFESR  1691
BYV       -------EVAPEP---------------------LSPEVDI----------------------------DVD----------------------------CD--------FGSDS  1808
GLRaV-2   -------ELVSSARRFCERVKVFLKQK------------------------------------------CVSLLSFLSCLF-----------------------------FSDAG  2092
AV-1      --EMIK-DLLAEI-E--------------------------------------------------------------GDA---------------------------E--VEDTS  1781
AcV-1     -------EFLDTD-------------------------------------------------------------------------------------------------FSD--  2170
BVA       ELTFLERQFSAPS-EICFFIFHHYYRTRG-----LKFAVDWF-------MSQGRGDETILPRVSG------SENPSVVDLL----LSLI-----NGYYPRCD--------FSCDS  2126
PeVB      PWVDEEMEIMTQR-----------------------VRVDEKTITMI--------------------------SGCVSDIQNDTLLSAFEANEVRNIGAWTK--------FLDFV  2099
ArPV-1    -------ELVQDS------------------------------------------------------------------------LASF--------------------------  1397
CoV-1     -------NVFKDQ------------------------------------------------------------------------------------------------------  1722
LCV       -------KIKDEE----------------------------------------------------------------------KSLALV---------------------ANEVS  1347
LIYV      -WRSTK-EVTNES------------------------------------------------------------------------------------------I------CKDLV  1250
GLRaV-1   -VTPVKVEVSAPR------------------NVQTAMEREKF--------KG-------------------ARKLVSSDI------------------------------FVDKL  1512
GLRaV-4   -------EVSCEE---------------SHLTCSCGIDINVKPFTVP------------------------------------APLPLI---------------------GGDKL  1672

FiVA      ERRHRLSERARR----VLREMMKKLGEVVSATGTFTRVNLAKVCCKILALCRGNDEFADRPGLRGGS---------------------------NTCISILRI----------FL  2140
FiVB      EKFMQFKIFARKKYFDTLEWLIGKLGIV------------------------------QKPGLRGGG---------------------------VSLFRVLLT----------LM  1871
RLMV      DDV--------------------------------------------------------SPGLRAGG----------------------------------------------PV  2006
RLRaV     SEVDE------------------ALSTISAA---------------------------NSGGLGGGS--------------------------------AGRW----------FI  1955
SCFaV     SS---------------------------------------------------------EGGLRGAG--------------------------------IGAV----------TV  1956
CTV       VSI-------------------------------------------------PLDRDFEQIGRLGGN-------------------------GNVDVVRLGLK----------FV  2302
BcLRaV-1  ETS-------------------------------------------------------DSPGLKAGG----------------------------RGVSIIGT----------LV  2032
CYLV      TST--------------------------------------------------------APGLFGDGHRI-------------------------SLISFIIR----------QI  1668
CNFV      -SM--------------------------------------------------------TPGLRGGGRT--------------------------TAYARVVK----------LL  1664
MV-1      EIV--------------------------------------------------------VGGLAGGARTNF------------------------NAISLIFR----------FI  1744
TV-1      ERI--------------------------------------------------------IEGLRGGASSN-------------------------NLLSFLIR----------SC  1718
ReV-1     ERI--------------------------------------------------------VSGLRGGGHPC-------------------------SILSLFLR----------AL  1715
BYV       ESV--------------------SSDEVASN---------------------------PRPGLHGGSRRSSNF--------------------LTSLVKVVFK----------LA  1846
GLRaV-2   DSS-------------------------------------------------------ASAGLRGGASRVTLFHL------------------FVRLASALLS----------LG  2124
AV-1      RA----------------------------------------------------------PGLRGGRRHANG-----------------------SISRTVVK----------IC  1805
AcV-1     -----------------------------------------------------------APGNFGGAVDCKSFVVSVY--------RYFRSFKFSSIVAMCQAILAFFVMTKRLC  2218
BVA       SAVYLFA----------------------------------------------HTDYGHAGKLNGGSPAATFWRLQTLI------ETISTTVRSSPSVGRATQ----------FL  2179
PeVB      KNQGDGF----------------------------------------------YFMEGSTAKLRGGSVKKTLFGSVILYILEEFAVRAKMPKVFGRLIGFFLAPKSW------LV  2162
ArPV-1    ----------------------------------------------I---------------LEGPTKTI---------------------------------------------  1406
CoV-1     -------------------------------------------------------------------------------------------------------------------  1722
LCV       TKYY---------------------------------------------------------------------------------------------------------------  1351
LIYV      HKSY---------------------------------------------------------------------------------------------------------------  1254
GLRaV-1   RGRDVAF----------------------------------------------YSKYSRRYVYNGGSHASQGWNKA---------------------------------------  1542
GLRaV-4   NGREAWF----------------------------------------------YSRKGDGYSYVGGSHVSRGWLNI---------------------------------------  1702

FiVA      RNFPFKLAFQCGLVAA-------------EILFP--------ACFGPRLVCSLMLARKAICAVR---------------------------ILRVIEPRF--TDLLIYSLRSE--  2203
FiVB      RKLPKKFLFQTLLVIL-------------EIYFP--------ASLGARLATSLIFVRRTTLTIK---------------------------ILKYVLEHA--ADVIIFALHSQ--  1934
RLMV      LSLTTFLL---------------------------------------------------TRLSR---------------------------FISLLIRKV--PFLSIFRVLN---  2038
RLRaV     ISLLKAIS-VSVRAF--------------VRFFP--------FK---PVVKAGLLS--TVSTNR---------------------------LLTQVCGHALFTKCFIVRDLI---  2012
SCFaV     VSILKFLLRICFKTI--------------LHPVV--------LK---SFVKSVLVY--ITHTVK---------------------------FVGPVVKGVTFPTYSIIRTLAK--  2015
CTV       LKLLRNLFDARSFKVLYGLLLQTLFYGGSVNKFVCRL----VFSLGTCLPFELLRF--ACSARR---------------------------LLKSLASFVYQTNLFSEVMVEH--  2382
BcLRaV-1  KIVMRCLFTRVPLKILYHI----------TKIFV--------FKHSLSLATH------ESLVYS---------------------------FIGCVLAWLSKGQLYTGALVAS--  2094
CYLV      RQFIKCALSKSSRSL--------------TLIFL--------LG---SVSNSLLFSKWSTTFSK---------------------------FWGLFMVFL-YPKSMIFPLVSE--  1728
CNFV      LGIAKKCISSSVFRT--------------LVDFV--------MS---SQVSAMLRSKSMTAMGK---------------------------ALVVLLCLI-RPQLFIVTII----  1722
MV-1      RFIAKLVFTSRFING--------------FLRYV--------KS---SFISSVINRRENTVVSR---------------------------LISSLVLID-DPASCFIPVV----  1802
TV-1      FKVVKGVLTTKTFKL--------------GFLFS--------LS---SILSSVLHNRDSSVTSR---------------------------CLATLLVLR-DLRLSTVALL----  1776
ReV-1     AWLMRRLCRMSLLRF--------------FFSFS--------LS---SFLSSIVGNEQAGVVSK---------------------------AIAFLLLLR-DPKLASIRLL----  1773
BYV       RRIPRLLFRLRNF----------------VAYFVER-----------RLASKRLKT-----------------------------------FIGLARLFDNFSLTSVVYLLQE--  1897
GLRaV-2   WEGLKLLLSHHNLLFLCFAMVDD------VNVFV--------------------------------------------------------KALGGLSFFV-QPVSSVFAAVLLQP  2176
AV-1      LKILKFLIRNPSF-------------------FV--------------LAKG--GTTAGLSTAE---------------------------LWFGRAQALLKPTSYLVTLL----  1854
AcV-1     MVRYRALMAEVKARLVNYKRNNPAVALVRLTEIVDDGEDRC-YRVPKDLFDADEQVRNLCRNSRPQYFKKMDVYRVPATIDYEDKNALVGNLVSPAIDFLMVHDSSDVSAIGL--  2330
BVA       IKICNRVLRAVGLTYTTF---------------------------GATLYYNKEISGPLVVVAE---------------------------ALKVILMGV-TPESAAFFIYHHHG  2239
PeVB      VRLFRAIISKYNDFELDWVRMKIMQREQAEKRLREKTGQR--LRFNPDLY---------CEVTRGE----------PSNADTVRD--IV--MVVNERDGFVHPETATIVLTST--  2250
ArPV-1    -----------------------------LDWFL--------TQYG------------------------VT-------------------LLITILFLCGGNVAYGIYLLLA--  1439
CoV-1     -----------------------------SREFVARH----------SLYNHARFI-NSIFLNR---------------------------WITCFVFIVVYSFSSSLQLTFS--  1768
LCV       -----------------------------FNWFTPEV-----LR----------------------------------------------SLIGMSTIILLMCPKLGVCLIIT--  1384
LIYV      -----------------------------IKYFD--------IKKA------------------------VW-------------------LLWFSLLIIFLHPTLGFFILFS--  1287
GLRaV-1   -----------------------------LDELREE------LKLD-ESYDH-------CLIQK---------YRKGATIGFHADDEKC------------YTSGVSVVTVNLNG  1593
GLRaV-4   -----------------------------LNRYISN------TGLNPNLFDH-------CLIQKYE---------CGAGIPYHKDNEPV------------YPKNNPILTIHVSG  1754
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FiVA      -----------HVPE------------------------SFKEKIEK----CLFM------------------SSKYYH-------IYVNLQEIVSKLRKR---------ASFLQ  2245
FiVB      -----------YIPE------------------------NVKLVIED----LLFS------------------FDRHYY-------LVQKVNAFFTKTQKY---------FWFMK  1976
RLMV      -----------------------LRFWGS----------RTADRLLS----VYSA----------------------FYNPFQ---FISSVFVWAFRNPGL--------AFTNTL  2083
RLRaV     ---------------------------------------VVGERANK-------------------------------WVP-R---LVVPIVEWK-RTPEC---------LRRKL  2043
SCFaV     -----------LLSY-------VQHFGGTL--------GRISDRL---------------------------------YFPMR---LKT---------------------FTRKL  2047
CTV       -----------LFSVSRLLYD--SRYFATV--------FSELERLNFYL-DYFLS------------------LPKRYLFPNSRARSCARVPVPVIRTEGV--------------  2443
BcLRaV-1  -----------KLPTKDEAFDLISRCFNALGDG-----VVVPDRLTV----YILR-----------------TLDFVYG-----RGVISIIREGALRV------------VYRLK  2155
CYLV      -----------TILR--------QKFLT-------------PLRS-----------------------------------------ILRKISAFSSYLEKI---------FYTKR  1761
CNFV      ------------------------RYFSS----------NFPKGKGK---------------------------------PKD---GIALFFSKTLALENY---------LYTKS  1758
MV-1      ------------------------RAAY-------------NRRGHR---------------------------------TYP---VVRKVVEPLLFLENL---------FSKRI  1835
TV-1      ------------------------RCWS-------------KSRLAS---------------------------------NSQ---VSDKFFKCVLYVERR---------FTHLL  1809
ReV-1     ------------------------RVFS-------------QLRSAR---------------------------------RSC---VFRSLFSYVLKAEEL---------FTRLL  1806
BYV       ----------------------YDSVLNAFIDVE----------------LILLN-----------SG------------SVNVLPLVSWVRGSLTKLAEA----IVGSGFASFL  1947
GLRaV-2   DRFAGY----------------SEKLVTAF-----EFILKCSPRAPALL-KTFFE------------GV-----------------ANSTVSKTVRKLLRF-----LVRKFKLRK  2235
AV-1      -----------ILDP--------ESIVQSL---------RKYIRALS----SFSSRMHRLNLSNN-------ALNRVFLGSVD---AVEAVVGEVMFILEF---------FVLKY  1918
AcV-1     -----------------D-FNLIKKVLGWTMTKDLVSRIPLARRCYPN--SILMVRKGGYVI-----------------FSANGKPI-------VSNCSDLHLTPEKFDVIFMRL  2401
BVA       SIYKSARRSWGYVPVS------IRRFLA-----------MKTNRLVA----LFWD-----------------GDSETFP-ATNAGSVLEMLEELDDQSNNS--------------  2301
PeVB      ----------PNFALYE-----LKEVLK--------LSLPVVERCSAR--------DADFKLILPWSDVEVD-------VGSNTEEVVEETT--VSSCADV--------IVQSVL  2317
ArPV-1    -----------------------IKYFTTFYSK-------------------------------------------------------------VVPLCNI--------AIST--  1460
CoV-1     ----------VMVLVI------ASKYYNAFMER-------------------------------------------------------------AISLANL--------SIAL--  1796
LCV       -----------LILLND-----YVKYLRS-----------------------------------------------------------------VCVKANI--------YLSY--  1408
LIYV      -----------IYPAIE-----IKRYYNN-----------------------------------------------------------------VVCFNNI--------KMSY--  1311
GLRaV-1   QA-------------------------------------RFRVRSNKT-------------------------------------------------------------------  1604
GLRaV-4   EG-------------------------------------MFSIRCNNGSGGVLLKPPSWFLMPF----------------------GFQITHQHSVTCATV--------RVSMTF  1802

FiVA      SK-------------------------------------------------------------------------------P-ILTC-RPVDETHVSRKELAVDVVEAL-ENMER  2278
FiVB      TT-------------------------------------------------------------------------------P-GRHQ-EEVPSTHVTAIHLEDDIITIL-DDIEM  2009
RLMV      STL-----R-FVHAPTPVVDAFQRNGLPFLFDDR------VVAFSRLCRWLAGDDIPRV--------------CNRRCYF-P-VATS-FDLSPVSEARSV---NFVDSV-ESVLD  2165
RLRaV     ------------------------NGLLKVVDDH------VLPFCRKYFFLEAAVIRWVW---SCLPITWKPTSRRLTTYPA-LSIK-TYHEDDSEGASGSSSDFISSV-ERTKE  2122
SCFaV     AD--------FMMCSEYSLTAVRIGNFLIRCESQ------VFEYIKSILRSRGKTHKAV--------------SVSSCQFKA-VSVS-EDDDDNFEAPAVA-KDFLNTV-QDAEK  2130
CTV       ---------------------------------------------------------------------------------APVRER-------------SLNDILDSL-DSLKV  2463
BcLRaV-1  HA-------------------------------------------------------------------TGGERVSGVSFSA--VPV-TKVGCVPESVTL--QTLIDDIVERREG  2198
CYLV      VA-------------------------------------------------------------------FSKIPDKRPAYLP-VRAY-KSGKEELNGKSSGVASIVESL-EKIAH  1806
CNFV      DA-------------------------------------------------------------------NGKTFIGSDRHTPTFEPV-EFTPRIENGL-----QVVKPS-ENLEA  1799
MV-1      YD-------------------------------------------------------------------EEKSETTSVSY----RRV-EVETRLPSPIVRG--EIITSV-ENLSN  1875
TV-1      YG-------------------------------------------------------------------DVETRVNQQLF----RRV-AVSSRVPTGINQG--EIVASY-KNISE  1849
ReV-1     YG-------------------------------------------------------------------EPTVQGNRQLF----RRV-AVSAREATCVSRG--EIITSY-ENIAE  1846
BYV       GRM----------------------------------CCRVSDW-------------------------CSSSSNAGCNFMSPVRTKGKFVPPSSSGSTASMYERLEALESDIRE  2003
GLRaV-2   RGG------------------------LRADGKG-------------------------------------------------FHRQ-KAVPVIPSNRIT--TDGVERLSVKMQG  2274
AV-1      ---------------------------IRSPVYG------VV------------------------------RKVKSKLFDT-VRTY-TPVPVVSGDAQR--KYATSEA-EALRN  1965
AcV-1     SGGLMGGG---VTSW-SFMLLFRC--LLDLLEERNIISCHVNIACKVTACAASSTYRWFTMADWILKR---------------IRGW-YTHGRYHQN-----EMEIKPL-SKVEE  2488
BVA       ---------------------------------------------------------------------NAESTVGSASNRQRVSLR-KTVQSHVDACRQF-KDGVAAM-LKLHE  2344
PeVB      SGTLLSDKVFDIRAWEKFLKIFRRE------------DVSFYYLDKNRGCLRGGSLRGVLFGSALLYL---------------VEQF-VSHKFVHPNVIHAIGFFLNPK-SWLTL  2403
ArPV-1    ------------------------------------------------------------------------------------------------------GCNINNL------  1467
CoV-1     ------------------------------------------------------------------------------------------------------NEDVRNL------  1803
LCV       ------------------------------------------------------------------------------------------------------GSVLKRT------  1415
LIYV      ------------------------------------------------------------------------------------------------------PHVIDRL------  1318
GLRaV-1   ------------------------------------------------------------------------------------------------------GEIVEHL---LGD  1614
GLRaV-4   RS----------------------------------------------------------------------------------------------------TEVITNL------  1811

FiVA      K-----KMEFLRLRAKLVEDQRSETNKSAF--------------------------------------VNELKDYETPERE--ECEKPNPYTDK-MK---AVSVEEE--------  2336
FiVB      K-----KNDFIDSRDVFLRSEKKAKEESRF--------------------------------------VRETLRADDIQPI--DVIKDNASSDV-CK---G----KE--------  2063
RLMV      L-----RSSVGLPRREVIDDSDSDTT------------------------------------------SESSTEPLAD------EPVVKASKGK--------AVLEE--------  2211
RLRaV     ALLFNER-------------------------------------------------------------PVKVAPPLVSVPT--IHPVQGAPKEE--------SVADE--------  2158
SCFaV     LLLVKERLSLRADREKRHNGKGSETAMSE---------------------------------------AESSSDSDEE------EAVMGASEEK--------T--EK--------  2182
CTV       SDL-KGKSTFVDD-------------------------------------------------------GESDSGSEHS----GSSISFGSVNEEVLNA-----------------  2501
BcLRaV-1  S---TKDAPLQRKGKSHVTGDKGKGVSETV--------------------------------------VETSDDSDSDLED--TKSVQGTMGNN---------------------  2249
CYLV      ---------IKQAVKTTMKSVERHSETFE---------------------------------------GSEISSGYSS------SSDEGAAVDQ---------------------  1846
CNFV      MN--ASRLLLRGIIDEAIRRSNSQNLTHE---------------------------------------TPRAED--VD------VPRLSAKAEREHD---SESFKGP--------  1854
MV-1      ---------LRDELDVLFKNAIPTNSGNE---------------------------------------SDPV----FD------TPGEGATGDLRQD--------EV--------  1916
TV-1      ---------LRSSLENVLDNSIG-KITEE---------------------------------------YDEV-----D------TEEAGASAK-------------V--------  1883
ReV-1     ---------LRHDLDATFKNFL-----PT---------------------------------------PDRA-----D------TREDGGSEVE-----------LP--------  1878
BYV       HVL--------------------------------------------------------------------------------STCRVGSDEEE----ERPKEVTEP--------  2026
GLRaV-2   VEALRTELRVLEDLDSAVIEK---------------------------------------------LNRRRNRDTSDD------------------------EFTRP--------  2312
AV-1      K------EELIKQIKLNLVSASVSAVVNESV-----------------------------------LKVEQAKGSSAS---------FGADSEA------TDSDSEE--------  2016
AcV-1     K-----TVTISEELKKIYSDTVKVKAERM--------------DELINEMVCRS--------------SDDVSGTTDL-----EISSEDSEGNSYNKKFFNKNLKNE-T------  2558
BVA       V----EARSMNPSVRKQFTGLLAQGVAEIARCSGTTMEPNLPYNEISNLIMSNSEWGDAGGDEEALLTSRKRKDAKAD---------LSAAEDG-VK---VVDHKNK--------  2434
PeVB      QFV-KGCYSWCSNFKSAYYNARETRRNSKLK----------RYDHVIH--------------------SHDMSDVSLHDISVALNSIKDAVNNPVAKCFPSSIIVEELVT-----  2482
ArPV-1    ----TTSSAIKKACKIVQERKFGRNARPT---------------------------------------GLKMQNNG-------KAEINDQTDDEFVT-DNHSEHSEQPVDKQDHP  1531
CoV-1     ----SFTSGLRKKVRTLTMQKFKNS--------------NI---------------------------SNKNQG---------DLNVQRETEKKIES---STALKPE--------  1853
LCV       -----IPSGRYKKLKEIFSSKFDKS-----------------------------------------LFTSKNRGND-------HAEGESEGGEEICR------------------  1459
LIYV      -----GGTYNFAKLKKAVREKFSENKSQGVK----------------------------------------------------ISEIPAEKDEDVMP------------------  1358
GLRaV-1   GDVFVMSPGMQRDFKHSVESLDEGRVSITLR------------NATVD--YCKREATE----------GKRVKGEVTPQ---SRVSVNDGKTSKEAKGL----------------  1686
GLRaV-4   -------DGVNRSLQLAVRGGGSNSQNHSST-------------------------------------EDKPKGNAST-------------------------------------  1845

FiVA      -----ANENS----AVET--------------KENLRWADLDDSYEDD---------EN-----ERADLV-----------------PEIYTNFKDM--------------RRPQ  2383
FiVB      -----AVISP----KVSK--------------KETRKWSEIESDDECDILETPKECVDS-----DRADLI-----------------PAIMKNFKDS--------------RRPS  2119
RLMV      -----ILEPV----GQPA--------------EA----------------------STS-----EKSVLMGIAESHR---------QETLSNVS-------------------SS  2248
RLRaV     -----GVGKI------P-----------------------------------------S-----SKIDLMPFAEAKR---------QDEVQSKK------------------MQV  2189
SCFaV     -----CEEEI----KVP-----------------------------------------S-----EKTVLHAEAEAFR---------VLEIGECSDTSTA-----------LRRSS  2222
CTV       ------------------------------------------------------VNGDSV---CEKAPLMKHVTA-----------LSRLERHPSGRKD---------IPVSRKT  2539
BcLRaV-1  ------------------------------------------------------GDTST-----EKPDLIEVAKTI----------LPEVVDVASTSKG------------NRKL  2283
CYLV      ---------------VTQ--------------TS-------------P------GAADS-----EKTQLL-----------------PIISEFATPRRE-----------VKHSA  1880
CNFV      -----RIEEL----DVPK--------------RSSKDNPD----SELP------RGEEE-----EVAQLLYNVD------------VPSTSNSPLPRKL-----------ERRRG  1908
MV-1      -----RAEEC----DVPT--------------NA-------------V------AVDEI-----ERADLT-----------------PFVAQATEEGKE-----------NERMG  1956
TV-1      -----RVEQC----DEPL--------------QA----------------------QEA-----ERADLT-----------------PYVSERLENDKE-----------CSEKS  1920
ReV-1     -----RVAEC----DVPK--------------RS----------------------EEI-----ERADLT-----------------PYVADILENAED-----------AARSS  1915
BYV       -----GIEHTS-EDVVPI--------------RSHSQPLSGGECSYSE------DREEN-----ERANL-----------------LPHVSKIVSERRGLE---------TARRN  2084
GLRaV-2   -----AYEQIQ---EVTTFC----------------------------------SKANSAGLALERAVLVEDAVK-----------SEKLSKTIDEM--------------ARKG  2360
AV-1      -------ESP----PVPV--------------QRDCKPTP------------------------ERADLTKVAS--S---------IPNPSPLVSEQ---------------RAG  2056
AcV-1     -DCL-RRENPVKGSEVRG------------KKKTGRKGNSIPTRSYEEW-----GDSDG-----AEGRFK----------------VLNIGNETKERFG--------KLYDGKR-  2624
BVA       -----AKVHF----DEPS--------------SSQLRDSE---CAEDE------FSTDS-----DNSDSI----------------LSPITALTEEKKGES-----GVKGVKSRA  2491
PeVB      KDAVGDEENNC-NKGITLGESSGSYKGKEKLISSGECWGDIACEASSS---GKAGGGDNI---DSRGDFIDKILKAATAEPPLVSSIPTVDEFKDTVNEIFESGEKAEPIVTKVA  2590
ArPV-1    RPHFERGESS----KTPT----------QRTVSEHLQPLAISTLNESEI--SVDLKDEN---------------------------LTPSEQLIKDRFT----------------  1587
CoV-1     --------------DFKS----GKA-------NSHVKLSEI----EEEI-----PSNDNY----DNA-------------------RTSSNETTNQLYQKNKM------------  1899
LCV       ---VGRTEKA--------------------------------SDVEVEL--GYDGKEVN-----KRQKHVNWGSEVS---------SANASDFVDGLQFSM-----LKPCVDRTQ  1518
LIYV      -----PLEEV----ETPK--------------RSVGRPSSKQDDIEDECN----IKEDPT----ESLNFS---------------NIEATSNRYDTLRVGN--------------  1413
GLRaV-1   ------------LGPVPS-----------SGVSS--------------------SSGES---------------------------VATVRQSASKSTIGTAV---EMGCIDKDS  1728
GLRaV-4   -DVSLRPQTTL-LKTVKS------------------------------------GNGEN-----SLLDVCAKNTGVK---------ITSVSDLLDKESY----------------  1892
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FiVA      LASS-----------SGKPM-----MDSNKGRMIGMSKFLIQLNLC-QDVPMQPPIEYE--KKERFFTNSMRDFYYTQRVALFELFTNYHE-------------KYMELVACGFN  2466
FiVB      VASS-----------SKETV-----SDDTTTRQIGMSKFLTQLNTN-QDVPMQPTIDYT--KGKARFTNSMRDFYYTQRVALFELYTNLHD-------------KFLELEACGFN  2202
RLMV      VLPG-------------PVVPSRRPRSPAKDNVVKICGYLQLLNSA-QSVPTGYDRDSSM-SNFSAMTNSIREFYYSQEVTLYELYSKLFD-------------YWREFVVLKHV  2335
RLRaV     RATQ-------------NCIPAKRKTSGSKRKGTQISKYLERLNNE-EGVPTSYQEADRR-SEFYSMTNSIREFYYSHEVALYELFMKMSA-------------LWEDALIVDFE  2276
SCFaV     KSRA-------------EVVQS---KSSSK---VPMCAYLNQLNSM-QMVPLNYHEDSSS-DPFRRMTNAMREFYYTQEVTLYEVYQKMAD-------------YWADFSACGFD  2303
CTV       FVRG---------------------ESSGVKSKVSMCDYLVTLNSSFGTVPDMYPVARD--ITYKKLTNAMREFYYSQKITLYELHGKLSS-------------YWDELKVAGFD  2618
BcLRaV-1  KGKE---------------------VREAQGE-LSPCAYLKTLNLG-VVTPSPFAVAS---GKGCTLTNSVREFYYLQEVALFEVYVKCMK-------------YYQEANALNFD  2359
CYLV      SGRK-------------EGL----------------CKYLQSLNIC-SRPPVPYTQVAPLPGNYSRCTNAVREFYFLQEVSLFDLHYKFLR-------------YWEQLKCMDFD  1952
CNFV      I-----------------------------------CNFLNLQNSY-CSVPTPYLPVSDNATTHRKCCEAIREFYFLQEISIFSLHTKLAT-------------YFHELNCLSFS  1974
MV-1      IDSG-------------RIIIPKLRKGNAA-----CCKFLNLQNIS-T--TVPTFSISNS-RSFPMCSNAIREFYYAQEMKIFSIHSKLLG-------------YYEELRAVDFN  2036
TV-1      IATT-------------SNY--KRGRNSAK-----CCKFLNLQNIS-A--TIPSMRAESL-GEFPKCTLAIREFYYAQEMVIFSVHSKLLT-------------FFEELSVVDFD  1998
ReV-1     NEVV-------------RPV--RKMRNSSK-----CCKFLNLQNIS-S--TVPSLSSGSL-GTFRKCTLAIREFYYAQEMVIFSVHSKLLS-------------YYEELEVVDFD  1993
BYV       KRTL-----------------------------HGVSEFLNAINTS-NEQPRPIIVDHS--PESRALTNSVREFYYLQELALFELSCKLRE-------------YYDQLKVANFN  2154
GLRaV-2   ATTSDEVAVALSDDEAVEEISVAEERDDSPKT-VRMSEYLNRLNSS-FEFPKPIIVDDN--KDTGGLTNAVREFYYMQELALFEIHSKLCT-------------YYDQLRIVNFD  2458
AV-1      TSQQ-------------------------------YSTYLNELNKS-GKLCAAPSYDVV--TPYRLLTNSVREFYYLQQIALFELHNRFRT-------------EFDKYEIYSFK  2124
AcV-1     ---------------------------------FELAEVIRNLD---LTCPPVFT------HTNDPALNAMNEFVFMHLMDVMNMLNSMKIASSL---------LVNDKRNPEF-  2687
BVA       VGRR---------QTKTKVVTPGRREREEK------CKYLLNIEGGNITPPSASVMGDSV------YDKAIGEYVYMNKYAVFETFEDLSN-------------KWKELVAYDFV  2572
PeVB      KSKG-----------------------------LVFSPYCRSLMGN-LVPPLAPEMVEDD------TINARNEYLYLKKQDVYNIMYDVTA-------------ATTQLESAG-E  2655
ArPV-1    --------------QSFRVLCKN--------PDIKRCTVF-------KHYPNTITTVMQ--NSWEPLTQCFNEYLFIESQTILQHLGKVSTLANVIRQGFVTIP-----------  1660
CoV-1     ----------VSYEASVNIINK-----------TKVCRDL-------LTYPNSSNFDFI--QTSDFLVNALREYIFLEKKNLMLNIKKLERVCDIYRSGTVK------------Q  1972
LCV       INCA------VH---------------------FPISHAL-------LRYPMTDCHDFI--PTGDLLLDCVSEYYHLEAKKLHDEMGRVNNAVRVYFEH-----QLETKSVKDAI  1592
LIYV      ---------------------------------SKLCKFL-------RFYPKSKCYANI--QTGDLIRDSIEEFYHLERSKLDIEISKMQRVVEI---------MNDTGRMLD--  1475
GLRaV-1   WVLGED-PVL-----GIQSFND-----------VVYCKDL---------------------KTAGTEAPAIEFIMYLAR-RCFDLFIKLKRARDL---------VAKTDKRVGHK  1795
GLRaV-4   ---------------------------------KGMKHYV---------------------SISGNVGAVIEAFLY----NLHELHKEISVISKA---------LEQPEILVGKR  1940
                                                                                     .

FiVA      PTLTSFSHDCDY-AVWDNRTKCEYTRNSKVNKLTTTHIW---KNNEYVF--------TKDGFVFSEEA--------EKYDI-CIYGEATSFLSANAFLFKQPN-----AAVTFEN  2555
FiVB      PMLTSFRQDSDY-IVWDNIQKKEYTKGTKTTLKSTSHIW---LTYDFVF--------CRDGLVFSENA--------EKYDY-CIYGESLKFLSPNAFLFKQPN-----PLVTFNN  2291
RLMV      REVCSLHQDEDC-IVVDFIRGEMVYKTGRKSL--KGRI----DAYSFGF--------CSDGLIPVE-LM------KGKYDY-CLVHTQTTFIAANHFLNSAPS-----RAIKFTN  2422
RLRaV     PQLCKATKEDGV-FVINFDQGFAYGANGKRSL-MDGRFI---NDYEFVF--------NSSGLCPTEVAL------KKRGGF-CIVHENLKFLAANAFLLNMPS-----RFIEYTN  2366
SCFaV     RKYSKIDQDDKL-FVLDFKLQKLIGKSATLNL--KGVY----SEYQFGF--------CSDGLIPLT-AM------GRKYDY-CLIHDQLKILSSNLFLCSCPS-----RLVKYTN  2390
CTV       RKLTRMDLDDDV-YVVDFNRKLLVGRNGSHPF--RNTL----KSYCFMF--------CNDGLVPCPRS--------QKYDY-ALISNQTSFVAANSFLRAVDG-----KDLTFTN  2704
BcLRaV-1  RGLLTCNEDSKL-VLYDCASRRMQMKNRVYFKSWEKVYK--EDGFRYCF--------SSDGLVPFTSE-------TVRGKK-VVLHEDIAFLPQNLFLRAVSG-----NNFRFTN  2450
CYLV      RTRTECEMDEDL-YVYTSSAMNFAPKKKSRVP--LG-L----AHHEMMF--------TEHGVVLNDPK--------YRHNK--LQHEQLAFVSANAFLRGCEY----HSSVVFDN  2037
CNFV      RAAAKCDEDADLRLLYNSRSCKVSSAKGKLSK--LREF----DDHEFCF--------THEGLVLNDPS--------SRVDK--LFHESTKFLASNSFLRSYEN----HKNAMFTN  2061
MV-1      RKAATCSQDVDL-SMYDPTSNTVHCGDGTNRG--LSKF----SSHQFAF--------TSAGLKPFDLKE------IQKQGTHALFHEQTHFLAANEFLKGFES----HSTAVFSN  2126
TV-1      RRAATCHQEVDL-LVFDPAKGTCINHEGRSQK--IETV----ADHQFFF--------TRDGLKPYNSK--------IKLDRHALFHSQTKFLAANEFLLGCES----HSTLKFRN  2086
ReV-1     RRLAGCHQDVDL-LVYDPSKGAAVNHESRLVK--RGTF----ADHQFFF--------SRNGLRPYDCK--------MQLNQPALFHAQTKFLAANEFLASCES----HSTLTFKN  2081
BYV       RQECLCDKDEDM-FVLRAGQGVVSGRNSRLP---LKHF----KGHEFCF--------RSGGLVPYDGT--------SRVDT--IFHTQTNFVSANALLSGYLS----YRTFTFTN  2239
GLRaV-2   RSVAPCSEDAQL-YVRKSGSTIVQGKEARLH---IKDF----HDHDFLF----------DGRISINKR--------RRGGN-VLYHDNLAFLASNLFLAGYPF----SRSFVFTN  2542
AV-1      RKEMLMDVDDDT-FVVAEGDSVAQGFNNSCS---IKEF----GRHEFCF--------AKTGLIRNSPS--------LKCNR--LYSKHMEFLAAERFLQGYPG----FASFSFSN  2209
AcV-1     --LRSDMVDPKI-TVLDTTTDLLWNTTTATVRL-------RDTQHRFCYDP------KSGSIVSLGAYR------VHSCSRYIVLHQDLEIFYANLILRRFEV----NEKIEKVH  2776
BVA       AERVSYIREPGV-YIFSTASRKPIGKPAKEAKL---------GDYEWGF--------VNGKLTKFNPSRLSL---ELIASKCIIVTEALKHFSSNQILAGMEK-----DCKEFTN  2661
PeVB      YELSDSAQNSNL-IIYDKDKKKFCGKRA--------------DSHRIEYGDKL----ESDLYCACGKNYCTFKEAMRCSSRYIVSHEQMAVFYSDKILMPLTV----NAYLYTPI  2747
ArPV-1    -EIKKMLNDSSLYIKLPNSSWESLGRKQVFLK----------KDPVFCFSPDVT---HTENYLDKDSI--------------LISTSEFEVGFANQRLVKMEAMLETTLMLPTAD  1747
CoV-1     KDIATLVDDRAVYMYQPSGLWFCLSNKIVKPL----------SEVKFFI--------TADAEIKNSQKDIREG---------CFTTDDFSIGYTNNRLFALEG-EHLDKTYLSSD  2059
LCV       WAMRNYFNDSSVYMNINSKAWYRLAKGDKGPST-IEAIC---------------KYTLDNDLIDFNTNHLNV----------VVCSDEMMGMFSNKRCLALESILKTSQEKIKTM  1681
LIYV      -NVRRMIDDRSMYVTLDGVSWYRLGCKDKNPAK---------EDFKAIFD-------HNFNIMEGNAKVKEF----------AVSSDEWRGMYSNERCRAIEQLFNDNNEMVRRP  1563
GLRaV-1   FPLAVYENLPGL-RVYDANFKVVANAPEDGTTI---------FDLEYVF---LV---STGTFVPGRNLE----AVLSRQDA-VLVCDDLLVFHDAMNLRGCVR-LAKRALVGEYM  1888
GLRaV-4   REVYSS-------CIPDLDRLKVCKQPETLLSSVVNSLYGSIEQKKIIF--------STDKSLETEDE--------------VLYLTPANISFALKRCIGMFQMMSKLTLVDIER  2026
                                                                                             .

FiVA      ASVKLLVYEAPPGGGKTHTLLDIFIEKSL----KHHILVLTANKNSSSEIRKKVVSRCEEK--KKDAKGQVPNATVLSRRVMTVDSYLINK---YAQKCEVLFIDECFMVHAGAI  2661
FiVB      IDVELLVYEAPPGGGKTYTLLEVFLAKIK----KLDIFVLTANRNSSDEIKKKVVKNA-DK--KLFSPDQVKR---LQSRVMTVDSYLINK---YNRKCQVLFIDECFMVHAGAI  2393
RLMV      ESVKIRVYEAPPGGGKTYALVESFCNMVP----KRSVVVVTANKNSQIEISKRVKNLLVAN-----NWKYHDAAAIVKESVFTVDSYLMHH---AYTKSHVVLIDECFMVHAGAV  2525
RLRaV     AEASVRVFEAPPGGGKTYALVDTYVSLKKD--GKKSVVVITANKNSQEEIVSRCVKTFCER-----GVEYVNAQRLS-MTIYTVDAYLMHH---TSVRSEVLLVDECFMIHNGAV  2470
SCFaV     CDIRIRVYEAPPGGGKTYALVQTYCRMIK----KKSVIVITANKESQLEIVRRAKSELKGNLKEGENLSLGDLKKLT-STIYTVDSYLMHH---INVKGDIMLVDECFMMHAGAV  2497
CTV       EEHSLIVYEAPPGGGKTHSLVNSYADYCV----KVSCLVVTANKNSQTEISQRISNELMGRK------LAAKYVTDAASRVFTVDSYLMNH---LRLTTQLLFIDECFMVHAGAI  2806
BcLRaV-1  SEVSLRLYEAPPGGGKTHTLIDLFSKCYA----VVNALVLTANKNSQIEISEKVMWKIKGL-----NMGQNEEILSVQPYVCTIDSYLMHS---PERKCEILFVDECFMVHAGEV  2553
CYLV      SNVCIMLYEAPPGGGKTTSLIDLYFSYTG----DFKCLIVTANKNSQIDIKNKVNKRAEKR--KAKSGEQASKAKGSGKDVMTIDSYLMNY---FSSKCDILFVDECFMVHAGQV  2143
CNFV      TNVDIKLYEAPPGGGKTHTLIQLYLMYSA----KCRVIVVTANKNSQVDILNKLKNSTDL----------PTSVKPDC-DVFTLDSYLMNH---LNERCTVLMVDECFMVHSGQV  2158
MV-1      EDVTIKLFEAPPGGGKTTTLIELYIERRE----KHKTFIVTANKNSQVEISDRVARKLAD-----------SEVPFDKRSVMTMDSYLMNR---CGETCDLLFMDECFMVHAGQV  2223
TV-1      TDVEIKLFEAPPGGGKTTSLIELYMERRE----RTKTFVVTANKNSQVEITNRISNELDE-----------DSPPFDKKDIMTMDSYLMNR---CGESCELLFIDECFMVHAGEV  2183
ReV-1     LDVEIKLFEAPPGGGKTTSLIELYLERRV----DFKTFIVTANKNSQVEITERVSKLIDS-----------DSPAFDKKSVMTMDSYLMNR---CGDTCDILFVDECFMVHAGEV  2178
BYV       LSANVLLYEAPPGGGKTTTLIKVFCETFS----KVNSLILTANKSSREEILAKVNRIVLDEG---------DTPLQTRDRILTIDSYLMNN---RGLTCKVLYLDECFMVHAGAA  2338
GLRaV-2   SSVDILLYEAPPGGGKTTTLIDSFLKVFKK--GEVSTMILTANKSSQVEILKKVEKEVSNIE-----CQKRKDKRSPKKSIYTIDAYLMHH---RGCDADVLFIDECFMVHAGSV  2647
AV-1      PVV-CMLYEAPPGGGKTTSLVQLLVQTVRS--G-TAVLALSANKLSREEIVKKVNSEFDNL--DMNIK--------AEELVFTMDSYMMNH---RGMECTLLLLDECYMVHAGLM  2307
AcV-1     YLNDLVVVETPPGGGKTTQLVALFFNLWMK---GVAVRVVTANKNSAEEIRRKASALALHFK-VVEQRYIPKLRQLLDDMVRTADSTIMNV---VSAKTQVLLVDEIFLMHLGQL  2884
BVA       TKLKAAIYESPPGGGKTQALVDVYVKFEK----RVKVLVATANAHSPKDIATRVLKVTGKKV-------DDASVDAICRRVRTFDSLVING---MP-DCDLLLVDKAFLVHAGQI  2761
PeVB      TVKAIRVVETPPGGGKTTEIVCLVVSMMRR---GIKFLCCTANKNSCTEIRKRAIGRYLNLV-PSNKAVVVQACRTLNDSVRTMDSFLMAG---EERSVAVLLLDEVFMVHSGQV  2855
ArPV-1    SVAELVAFNQPPGSGKTTNIAQHMVEAMRK---NRLCLAVTATKVGCSELRNMLSKLLKVSR---------------VNNVHTIDSFVLHG---QRRTVDLLLIDECYMAHSGQL  1841
CoV-1     ILSKITLINKPPGSGKTRAIVNTMVKLIDN---KQSVLALSVTRVGKDEIVEK-SRAHGINR---------------TDCVNTVDGFIMRN---VKYCVSKLLIDECFMAHCGSI  2152
LCV       RSKDIVFYNKPPGAGKTTSIVAAMAEDVKN---GIVSVALTHTSNGKKEIISKLKAKGVSAA---------------QKMVYTYDSVLMND---TESTVDKVYCDEIFMVHAGEW  1775
LIYV      DVNGLKFYNKPPGAGKTTTIAKLMSKDLKN---KVKCLALSYTKVGRLELIDKLKKDGIEKP---------------EKYVKTYDSFLMNND--NILEIVNLYCDEVFMMHAGHF  1658
GLRaV-1   KNVRLSAVNSPPGGGKTTRLVDEYFGR------KKRAKIATANTGSAADINSAIRAREGKKE--------------TDLVAKTANSWIVNSR--PRPNSHVGLIDEVYMLHKGMF  1981
GLRaV-4   AIVGCKFINAVPGAGKTHEIKLLMKSHAQNKFTKGLMIVLTSSRNAAESLNTYWEDELNDKR----------------VLVMTVDSFVFSGGKFSSREVESVLLDECYMSHAGLC  2125
                  :  **.***  :                    : .  .  .:                                * :. :.               *: :: * *

FiVA      LTCLSATKCRAAVFFGDSKQIHYIHRNDYGNSTA--------NQHDIDLFLHPDCRLPGTVSYRCPNDVCLWLAK---------EYKHDVVSKNKFVEPDVKTMSIVEIDCSEDV  2759
FiVB      LTCLEATGCKAAVFFGDSRQIHYIHRNDYGNSLE--------TMYDLDKFIKDSCKMPGLNSYRCPNDVCLWLSK---------EYGHKIESKNKYVDPESKTMSITEIDEVGDV  2491
RLMV      CAVLTFTGASLAVLYGDSRQIHYIHRNDLGLSL----------LHDINNFLSDDSRVYGNVSYRCPWDVCAWLSE---------IYPTRIQSMNE-KSAGTSSMSVTEISCVEDV  2620
RLRaV     AATINFTGAKKCAFYGDSRQIHYIHRNELGISE----------YHDLNMFIPDTSRVYGEVSYRCPWDVCEWLST---------FYPRHVKSMAR-DSVGKSSMSVSEITNESDV  2565
SCFaV     TAAFQFSQCKKAALYGDSRQIHYIQRNDLGCSL----------LHDINDFLSDEVRVYGDVSFRCPWDVCEWLSL---------TYPVHIRSTNE-DSVGKSSMRVVCINSVEEV  2592
CTV       GAVVEFTSCKAVVFFGDSKQIHYIHRNDLGVSF----------VADIDAFIQPEHRIYGEVSYRCPWDICEWLSE---------FYPRHVATANV-GSIGKSSVSIEEINGCDDV  2901
BcLRaV-1  LAALEFTKCKVALLFGDSRQIHYIHRGELEASR----------FSDLNNYIDGSGRIYGNKSYRCPWDVCEWLSK---------QYENKISSVAH-NTVGESSCSVKLVECEEDL  2648
CYLV      LAIINASQCRRCILFGDSRQIHFIQRNETCSSF----------YGGLNSFIPPSARVYGEISYRCPWDVCQWLSK---------VYKNAIKSNNI-ESLGKSSVAIREIEGLDSV  2238
CNFV      LMCINSTVCNVAVLYGDTRQIHYIERCELIKPK----------YSDLENFVRPECRTYGHVSFRCPWDVCCWLSE---------VYSSKIMTVKA-SSVGKSSVTVVPTSAVEDV  2253
MV-1      LGIINKTMCKVAILFGDSKQIHYIERDEFVSTV----------YHDIDSFIEPFCRMYGEISYRCPWDVCEWLSK---------LYKRQIKSNNT-SSIGKQSVSVVNIESVEDV  2318
TV-1      LAIINKTMCKVAILFGDSKQIHYIERDELVKTT----------YHDIDSFIEPFCRVYGEVSYRCPWDVCEWLSR---------LYNRKIKSHNQ-ESVGRTTVKVETVESVDDI  2278
ReV-1     LAIINKTMCKVAILFGDSKQIHYIERDELVSTI----------YHDIDGFIQDFCRVYGEVSYRCPWDVCEWLSK---------VYDRRIASNNR-ESVGRSSVRIAPIESVDDV  2273
BYV       VACIEFTKCDSAILFGDSRQIRYGRCSELDTAV----------LSDLNRFVDDESRVYGEVSYRCPWDVCAWLST---------FYPKTVATTNL-VSAGQSSMQVREIESVDDV  2433
GLRaV-2   LACIEFTRCHKVMIFGDSRQIHYIERNDLDKCL----------YGDLDRFVDLQCRVYGNVSYRCPWDVCAWLST---------VYGNLIATVKG-ESEGKSSMRINEINSVDDL  2742
AV-1      VACIEFSSCSVSVLFGDSRQIHFIDRSELVKPE----------YSDVDHVFCGMERVYGTTSYRCPWDVCAWLST---------FYPKKIASVNE-GSEGKSSMDIVPIDNCDDV  2402
AcV-1     ILNFEILKPMYVIGYGDSKQISYIPRTDLYCPV----------YHNVMDIIDEGRIIYRSESYRCPKDVCFLLSE---------LYGRSIEARVN-NRTD--TMSVASISSIEDV  2977
BVA       LHVINKTMCKAVVLFGDSKQIKFINRQRLLSLV----------HGDIDNFINRSNRFYTDVTYRCPHDTSLWLTA---------VYGRVITSKAP-KNILS-SMTMKLINSISDV  2855
PeVB      LNVFTRVRCERIIGYGDSNQIGFISRTDHALNK----------YSHIGEMIPEVCQEYRTVSYRCPKDVCELLSV---------IYKRNIFNPYY-KASS--SVSIKEISCVEDV  2948
ArPV-1    CYLLANVTAMQIEFFGDRNQIPYTCRIDDFVAR----------HAS--SLFKYVKIVDDDKSYRCPADVCYLLSQLCDDQ-GNRLYSKGVYAAKN-PRLR--TMNVKEINGIADI  1940
CoV-1     VHILKNVTFDSCDMYGDINQIPYICRIPHINVE----------YSK--TLFEMVSVEHDNSTYRCPLDVCYTLSQITDAM-GRKIYKGGVYSKLN-TKVR--SMNCVGIHAFEEI  2251
LCV       LAVMSLYKTNFIRCYGDRNQIPFINRVAHTVCR----------HHK--DIYLTFKTIDDNISYRCPVDICYLLSTLTDEA-GNLLYPNGVYPAGD-NRNVFRSVEVEGITGIHDI  1876
LIYV      LTLLTKIAYQNGYCYGDVNQIPFINRDPYTPAY----------LSR--EFFRKQDLNYDTYTYRCPLDTCYLLSNLKDEM-GNIIYAGGVKNVNE-VYPTIRSLNLFGINVVGEV  1759
GLRaV-1   QLTVVAMGVKEVIAYGDKNQIPFINREKTFVTP-----NEAVEFAE--ELIE-----YTDISYRCPADVCYVLSSMTDMR-GAKLYPNGVFPNGD-TRPLR-SFEKVPIATPEDA  2081
GLRaV-4   ILISAITNPSSLSFYGDRRQVPFVNRNPIFRDTVGMLNIKRGDYSE--KLL----------TYRCPADICYWMSTIDFLKPGARLYSGKVTTVKD-KRPLK-SVKVTPFSPNQLD  2226
                        :** .*: :                                      ::*** * .  ::           *   :            :
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FiVA      PLEEDVKYLTFTQSEKRELQNVLDKK--SKITKSAPVVVNTVHEVQGDTFKQVRLVRTKYQEEGPFSSKNHIIVALSRHTHGLKYMVLRGRLYDDTASCVRLAQTLCA----EYK  2868
FiVB      KYVEGVKYLTYTQSEKRDLQNALIKK--HNDKLTKPPVVNTVHEVQGDTFEKVFLVRCKYQEEGPFSSKNHIIVALSRHTHELKYNVIRGRSYDDTASCIRLAQTLCD----EFR  2600
RLMV      PLDQKFKYITYTQGEKRDLSKHLAVR-ATASNCKKVPEVNTVHEVQGDTFAHVCLVRFKYQDDSPFSSQNHIIVALSRHTDSLVYHVLSTRRYDDTSSAIAKSKLIVA----KFK  2730
RLRaV     PERPGFKYITFTQAEKRDLQKKFDLS-------RFKTVVQTVHEVQGETYSNVALVRTKFQDEAPFTSLNHITVALSRHTDSLTYYHLGQKKFDEINGHINNARRIVE----NFK  2669
SCFaV     PVDQDHVYLTYTQDEKRDVRKHLLKS------VTDCPVVLTVHEAQGATYKYVNLVRVKFQENTPFSSYNHINVALSRHTDHLVYYVLVNRSMDDTASAITRTKKLVD----RFR  2697
CTV       PYDKAAKYIVYTQAEKNDLQKHLGRL--TVGRNKVVPIVNTVHEVQGETYKRVRLVRFKYQEDTPFSSKNHIVVALTRHVDSLVYSVLTSRRYDDTATNIDRAKEIFD----KFR  3010
BcLRaV-1  EISPHTKYLTYTQEEKHRVQAYLNKR-------HLKSEVNTVHEVQGETYTKVDLVRFKFQEDAPFSSMNHIVVALSRHTRSLVYNVLGARSTDRTCVEIEKMKKICE----EFR  2752
CYLV      PILSGVKYVTFTQGEKSELERFLKPK-------LPKVEVNTVHEVQGETFSRVALVRTKYQEDTPFVSENHIIVALSRHVESLHYYVLSSRCFDDTSRAIKEMMEISE----KYK  2342
CNFV      PIDSSSKYVTFTQSEKQELQKLVDRTL-----GCGVSVVNTVHEVQGETLKESSWFVISFKKIHPLLSQNHVIVALSRHVESLHYYVNNARIYDDTSRAIGRMHDIAE----KFA  2359
MV-1      PFVQSIKYLTYTQSEKAELRRKFEKF-------SSEPSVNTVHEAQGETFKNVYLVRTKFQEDAPFVSENHVIVALSRHVESLHYYVISARCYDDTASAISTMLDISE----KYR  2422
TV-1      PHFEDVKYLTYTQSEKSDVHRKFSRE-------KKVVNVNTVHEAQGETFRRVALVRTKFQEDAPFVSVNHIIVALSRHVESLTYYVLSSRVYDDTSSAINTMLDIAE----KYR  2382
ReV-1     PYTEGAKYLTYTQSEKSDISRRFSRE-------KKRVDVSTVHEAQGETFKRVILVRSKFQEDAPFVSLNHIVVALSRHVESLCYHVLSSRVYDDTSAAINTMLDIAE----KFR  2377
BYV       EYSSEFVYLTMLQSEKKDLLKSFGKR---SRSSVEKPTVLTVHEAQGETYRKVNLVRTKFQEDDPFRSENHITVALSRHVESLTYSVLSSKRDDAIAQAIVKAKQLVD----AYR  2541
GLRaV-2   VPDMGSTYLCMLQSEKLEISKHFIRK------GLTKLNVLTVHEAQGETYARVNLVRLKFQEDEPFKSIRHITVALSRHTDSLTYSVLAARRGDATCDAIQKAAELVN----KFR  2847
AV-1      QVLPDAKYVTYLQSEKIELQRALAKR-------GYRGEVNTVHEVQGETFRSVCLVRTKFQEDEPFKSDRHITVALSRHTHSLKYFVLSSKSNDMTSECILRAKHLVD----QFR  2506
AcV-1     PVVEDAKYLTYTQGEKYELSNTLRRK---GRRSLPYLDPQTVHEAQGNTYKKVILVRSKPQDDSVFSSVQHHTVALSRHTDSLIYYCISSKYNDDTASKIERSKVLSSINMNEIN  3089
BVA       THNANCQYMVYTQGEKNDLLRELRSRD-----PDQHFNVNTVHECQGGTYDHVILVRTKVQDDSVFSSEAHNIVALSRHTESLEYDVAVSKAGDTTSENIKVAESMIK----TLK  2961
PeVB      PMVNGFKYLVQTQAEKLELLKKVKMQ----GNIEPKYFPQTVHEAQGDTHDHVYLVRTKPNDDEPFVSDAHNVVAISRHTRSLTYFVIRSKTDDIMSFMIRKCVELQEMADAMVD  3059
ArPV-1    EFDKDTTYITYTQAAKAELNNAFNID-----------TVRTVNEIQGATRPHITLVRLDNFENPLYRDTHQFVTAISRHTETFTYLTTPVNVNDTVGGAINSLTTIAD-------  2037
CoV-1     PFKNGDIVMTFTQNEKNEIEKFNKTL-----------FVKTINEIQGATYKDVKLVRSKVYADEIYDNVNQIVTAISRHTDSLTYYTPYSCLNDKVSTMIKDTRNVND-------  2348
LCV       TFDSQSKCISFTRPEREEIDAAFQRS------GVQGLSVQTVHEVQGGTFPSVNLHRLRKYDNPLYENINQFVVSISRHTERMKYRVITDKMFDRIGERISALYNVQD-------  1978
LIYV      PVEYNAKYLTFTQDEKLNLQRHIDSQ------GGCRNAVSTVNEAQGCTFSEVNLVRLVQFDNPVMSDINQFVVAISRHTTTFKYFTPHSRLNDRVSNAISSLQSVSD-------  1861
GLRaV-1   LLYEADVYLTMTQNEKAEMQRVVAKM--EIAAGKKRPDVLTTHEAQGKTYGDVVLVRLKKADDPIFSRKPHIVVALSRHTRSMKYAVLSSKMSDTISKLID-------------  2180
GLRaV-4   FMKSVDRVMTFTQMEKTDLISKFQIA-GFGNKEEATNLIGTVAESQGETYARVALVRTKAADDPVFGSFPHRLVALTRHTVSLQFVCLPNKMSKGIGSDCKMIEKLEA-------  2333
                  :   :  :  :                     *  * ** *                     :  .:::**.  : :        .

FiVA      NNFYG-ESSDMSWDMESYPE-----GNKGAKAVSSPYQSINSFLETVVGGSTQIELGDMSLEMSSQPFESSVDGVTIQEGNT-GRRSATHGVQRV--------------------  2956
FiVB      NNFYG-QSSELDWELQSFPE-----NFKNAKAVSSPFQSINNFLEEVIPGTTQISLGNLSAELNTQPFECTVDGVVIQDSNS-GRNNAAPGIQRV--------------------  2688
RLMV      QYPGGECSSTLSWSKGPYPD-----KPGECKAASSPYQCITQFLEDAVPGSTVVDFGDTSLEMSEQPFESGADNVTIKETTS-RDSGSVQDPRRV--------------------  2819
RLRaV     GLPESLTSSKLSYELGPMHE-----QSGECKAASAPYEVISLFLNDVIPGSATVDLGDLSEELSHTPFESGCDDVVIRESSADTRGTSAQAPHRVRLCEESSDTEEAPIAPREPA  2779
SCFaV     VYPQEFSTSTLQWNMGDMYE-----GKEECKAVSTPYQCINDFLEDVVVGSTTLDFGDMSSELSDQPFECGVDGVIIREGNNLRNNGVAQNPARV--------------------  2787
CTV       SSNHSYGSSSLEWYLEKYPT-----EYKGSKASSAPISCINEFLNEVVVGSSVVQLGDVSEELSSRPFESGCDNVTV--------------------------------------  3082
BcLRaV-1  KNPY--TNTSHSYSISGITPAP---DHNKSKPCSAPIEIINYWLDDVLPGCGFGDMGDPSDEMRSSPFECGVDNVVVTDAAP---KESVSTQQRV--------------------  2839
CYLV      TLPNYFSGSSIQMEVTGEPV-----DNSSCKALSAPLQSLNDFLEEIVPGSTSINFGDPSAEMSVSPFECAVDGVTIHAGDN-GSRLHDHDPARV--------------------  2431
CNFV      TLAKNFESSYITMDVKGVHE-----DNSRCKALSAPFDSINAFLEEVVVGSTTVNLDDISSDLSSSPFESGADDVTLRESSV-NTFVSDHTEQRA--------------------  2448
MV-1      TMPRSFETSSISMEVSGESP-----DDSRCKALSAPHDSINSFLNEILEGSNSINFGDLSAEMSSQPFDCGVDGITVREASD-EKVYDDHTNRRV--------------------  2511
TV-1      TAPRSFESSIIEMNVSGDHP-----DESRCKALSAPQDSINSFLNDVLGGSNTLNFGDLSAEMSSQPFDSGVDGVVIREAGN-EKIYDDHANQRV--------------------  2471
ReV-1     TMPRSFETSSISVDIVGEYP-----DDSRCKALSSPLDSINSFLNDVLPGSNAINFGDLSAEMSSQPFDSGVDGIVIRDAGN-EKVYDDHTNQRV--------------------  2466
BYV       VYPTSFGGSTLDVSVNPSTS-----DRSKCKASSAPYEVINSFLESVVPGTTSVDFGDVSEEMGTQVFESGADNVVIRDSAP-VNKSTDHDPQRV--------------------  2630
GLRaV-2   VFPTSFGGSVINLNVKKDVE-----DNSRCKASSAPLSVINDFLNEVNPGTAVIDFGDLSADFSTGPFECGASGIVVRDNIS-SSSITDHDKQRV--------------------  2936
AV-1      IHPTSFEGSTLKLYVDESAV-----DNSTCKAHSSPIGVINDFLEDVIPGSTSISFGDPSAEMSNEVFESGADDVVIQDCSG-LDKGSAHGEQRV--------------------  2595
AcV-1     EQP--IIGAEYECSGGNPAA-------SCSRAGAMGWQAIVSFLDEVVPGSTVLTLNDISEALSTSEFESCVDKIRIGENMTVGKQPLHSNCQRVWRNKVTGCSR----------  3185
BVA       QS----NCDSLGEFYERYPEKLNFLDRKKIPVSSAPILTINDFLESVVPGSTTFEFGDMSKDMASSNVTSCVDNIRINTGVS--PNVTGESTQFV--------------------  3050
PeVB      KSPENLVGEEEDISSEREMS----FRDKISPVGSAPYTAIVEFINEVVPGSTSVVLGDMSQALNTSEFISDASGVTISAGKV----VSASREQRVWRH-----------------  3149
ArPV-1    --------------------------------------------------------------------------CVIAQFGF---------KQCV--------------------  2049
CoV-1     --------------------------------------------------------------------------FIISQFYF---------KQRV--------------------  2360
LCV       --------------------------------------------------------------------------YIIKEHMF---------KQRV--------------------  1990
LIYV      --------------------------------------------------------------------------FVLK-------------------------------------  1865
GLRaV-1   -----------------------------------------------------------------GTYAGKVSDVLLQQLQR-------NDRFRV-----------------D--  2204
GLRaV-4   ---------------------------------------------------------------------SVAKTFVVQ--------------HHV--------------------  2345
                                                                                      :

FiVA      --  2956
FiVB      --  2688
RLMV      --  2819
RLRaV     VL  2781
SCFaV     --  2787
CTV       --  3082
BcLRaV-1  --  2839
CYLV      --  2431
CNFV      --  2448
MV-1      --  2511
TV-1      --  2471
ReV-1     --  2466
BYV       --  2630
GLRaV-2   --  2936
AV-1      --  2595
AcV-1     --  3185
BVA       --  3050
PeVB      --  3149
ArPV-1    --  2049
CoV-1     --  2360
LCV       --  1990
LIYV      --  1865
GLRaV-1   --  2204
GLRaV-4   --  2345
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Fig. S1b. Alignment of RNA-dependent RNA polymerase (RdRp) (ORF1b) sequences of FiVA, FiVB, and related viruses

RdRp domain sequences used for the phylogenetic analysis are marked in yellow

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FiVA        SWVRSQAIPPRKSSLQENLYSYESRNYNFLKTGRISSEKEFGKGLAACVVERAFDPEACAKAQREVLTLSVNAMAKWLQKRSGEKKMGLIKEFSTP-HEMELDINRFKLMVKADA   114
FiVB        SLIRSQAIPPRIESLQENLLSFESRNYNFLKTGRISSESHFGKGLANHVVVRAFDPERYALARREILTLSVNSLAKWLQKRSGEKKLNLVSEMASP-RDLENDINRFKLMVKADA   114
RLMV        SYIRSQAIPPRRPSLQENLLSYESRNFNFIKCERFSSPKLFGAAMASNLLLKLFDAEKLAEVRQSVISISEANIAKWLLKRDASQVKALMTDLDRD-FDIMDDISRFKLMVKRDA   114
RLRaV       GFVRSQAIPKRLPSLQENLLSYESRNYNFLKSERHCDPKVFGEAMAMAVLKKCFNLEKFATLRDEVIGVSELATAQWAAKRDENQLRNVFRDFERRHLDIGADVSNFSLMVKRDA   115
CTV         GVVRSQAIPPRKASLQENLLSYESRNYNFIKTERFVGPSEFGRAMAAAVIERCFKMEEMAKIRCDIISLTEANILKWLDKRTPCQIKAVHGELKLP-FSVEEQISNFKLMVKRDA   114
SCFaV       SYVRSQAIPDRKASLQENLYSFESRNYNFLDCERFSSPKQFGIAMAMAVLKSCFNLEKFSTLKDDLIAISEKNILKWLKKRDESSCKALMKDIEKP-FDLETEISNFKLMVKKEA   114
CYLV        SIVRSQAIPQRKPSLQENLYSYESRNYNFLKCDRFSSPEIFGKAMATSVLRKCLDAQKLAEVKKETIAFSQSALLKWMSKRDTSQLKSLQAEFGKP-LQLDTAIHYFKLMVKRDA   114
CNFV        SVIRSQAIPPRRPSLQENIYSYEARNYNFLKCDRLSSPEVYGRAMARNLIDRCVNPEAFLKATENTIAFSKMSLLQWLNKREPSQIKSLQSELSRP-LDLDTAIHYFKLMVKRDA   114
MV-1        SLIRSQAIPQRTPSLQENLYSFESRNFNFLTCERFASPSVFGKAMARNLVERCFGDCDFLSFKNSPICLSSGALLKWLAKRDSSQIKSLQSELNRP-LDLETSIHYFKLMVKRDA   114
TV-1        STIRSQAIPPRSPSLQENLYSFESRNYNFLTCERYSSPTVFGKAMARNLIERCFTTDKFLEFKNSPIRFSDSALLKWMQKRDSSQIKALQSELTRP-LDLSTAVHYFKLMVKRDA   114
ReV-1       SIIRSQAIPPRTPSLQENLYSFESRNYNFLTCERYSSPSLFGKAMARNLVERCFNTDKFLEYKNSPIRLSTGALLKWMQKRDASQIKALQSELTKP-LDLSTAIHYFKLMVKRDA   114
BYV         SSIRSQAIPKRKPSLQENLYSYESRNYNFTVCERFSGPQEFGQAMAMVMLERSFDLEKVAKVRSDVIAITEKGVRTWMSKREPSQLRALSSDLQKP-LNLEEEITTFKLMVKRDA   114
AV-1        SVVRSQAIPKRKPSLQENLLSYESRNYNFITTERFSHPNMFGEAMAYNTLERCFDLSKVDLIRNDIIALNESAMAIWLNKRTPSQIKALLKDLETP-YELSREIIRYKLMVKRDA   114
BYSV        SVVRSQAIPKRRPSLQENLLSYEARNYNFITCERFSGPHEYGRAMAANVLKRCFDLDKVAAIRSDIIAITGRGFREWLSKRSPSQKKSLASDLETP-LNLEEEIVRFKLMVKRDA   114
GLRaV-2     SVVRSQAIPRRRPSLQENLYSFEARNYNFSTCDRYTSASMFGEAMAMNCLRRCFDLDTFSSLRNDVISITRSGIEQWLEKRTPSQIKALMKDVESP-LEIDDEICRFKLMVKRDA   114
BcLRaV-1    NYVKSQAIPKRKASLQENLYSFESRNYNFIDSAKFSDPTLFGFCMAENFFKRCCHFDRIAEIKNEIIALSDEGFRTWFEKRDAAQLKALYRDMEDP-YDIEMEINRFKLMVKSDA   114
BVA         SVIRSQAIPDRTPSWQENLYSFESRNFNCINVKSHMGCDRFGAFLGSATLTRAFNPDKLADLRGEIATLTTVGVKNFLSKRSETQIKDLLSECDKP-LDFLDDITLFKLMVKREA   114
AcV-1       GVIRSQAVQDRKPTVQENIYSCEARNFVALTLDRHLDPDLFRDHAVKKFFDKCVNSEVLRGLNEQPIVTNHLHFQEWLRKRDGSALAKLDSEVGYI-TTWRDYMCLFKLMVKKEA   114
PeVB        ---NTQAIPDRLNTVIENVYCYENRNFVAVTHEKNEATKVFAARALDSVLTRCFDREKLSVVCNDSISLRERCFHEFLRKRDNTFFSNMSMEGVNI-RNFSDYMSMFKVMVKREA   111
ArPV-1      PNLLGKGERSRPNTWRQVLLSLSNRNFAAPNINENLDVEHISKILFTAFL-KCLRKDRSSEYF-ESIVPDIHKIDEWLTTRDSRKYANVLKSLDTT--PWPTLIQNMKLMVKGDI   111
CoV-1       PKILGKGERSRPNTIRQALISLSNRNFAAPDINHDHDLVQSANILFKGFL-KCLNMQKVLEFD-DVVESDLNKIDKWLSTRDTRKYNALLASLNYE--PWNKDISNLKLMIKGEL   111
LCV         TNLLGKGERARPNTWKQALISLSKRNFSAPRINEKLDVLATAEKLCQGLF-RCFNFSKLMEFY-DPVVPDLNKLGEWLASRDGSKYGKLKRSFNHT--LLVDQFQPMKFMIKSDM   111
LIYV        SKILGKGERNRPNTWKQVIQSLSHRNFNAPIINHKLDVKRSAQILYDSVV-KSLRQDRLTEWY-EPILPDLFKIGKWLDDRDGSKYRMLNRRLDFA--SLADKFKTLNLMVKGET   111
GLRaV-1     NVVRSVIGRPKRNSLKCNLVTFESRNFNADRGCDVSSDPIAATELASLFFDTWVDGSKLAECVGDTISQNAVAASSWLDSRSSMAKQSLWARLRSF-VYDLSAMTRYKLMVKSDA   114
GLRaV-4     PRLRSHVMTKRLNTLKSNILAYEKRNFCGESKSWHPDVTAEVSMIVDCFFDSYIDKIKAEKLMSDKITVNLKDLSDWYTSRTPLGKGGLDRELKNP-DILGPNLNRFKLMVKADV   114
                      :  :    :   . **:                     .               .           :   *       :              .   ..*:* :

FiVA        KVKLDASCLSKHPPAQNIMFHDKYINALFSPIFDEFKNRLMSSLADNIVFFTEMSNSDLAEIVRRK-IGDED-VYHVAELDISKFDKSQDGYVKAFEEEMYRM--FGFDPELLE-   224
FiVB        KVKLDSSCLSKHPPAQNIMFHEKYINAIYSPIFDEFKNRLLSSLYDNIVFFTEMSNSDLAEIVRRK-LGDED-VYHVAEMDISKFDKSQDGYIKAFEEEMYSL--FGLDTELLE-   224
RLMV        KVKLDDSCLSKHPPAQNIMFHRKALNAVYSPCFDEFKNRFLYCLPPNIVFFTEMTNEDLAEIIRRR-LGDDD-IYNIGEVDFSKFDKSQDVFIKEYERALYEA--FGFDVELLE-   224
RLRaV       KVKLDDSCLTKHAPAQNIMYHRKAINALYSPFFDEFKNRLLWCLNSNIVFFTEMSNSDFASVVRRH-VGDED-IFYKGEVDFSKFDKSQDAFIKEYERALYSA--FGFDAEMLE-   225
CTV         KVKLDDSSLSKHPAAQNIMFHKKFINAIFSPCFDEFKNRVLSSLNDNIVFFTEMTNAGLAEIIRRI-IGDDD-NLFVGEVDFSKFDKSQDLFIKEYERTLYSE--FGFDTELLD-   224
SCFaV       KVKLDDSCLSKHPPAQNIMFHRKAVNAIFSPVFDEFKNRVLYCLNSNIVFFTEMTNDHFSQILRRL-LGDQD-VYNVGEIDFSKFDKSQDIFVKEYERTLYEA--FGIDSELLN-   224
CYLV        IVKLDSTCLTKHPAAQNIMFHAKAVNALYSPCFDEFKNRFMSCLLPHIVFFTEMDNRAFASVARGV-LGRCAQELFVGEVDFSKFDKSQDIFIKEFERCVYSQ--LGFDHELLD-   225
CNFV        KVKLDSTSLVKHSPAQNIMFHAKHVNALYSPCFDEFKNRLMSCLHSNIVFFTEMDNRQFARVVSGL-ISDYDDEYRIGEIDFSKFDKSQDIFVKEFEREIYSL--FSFDAELLD-   225
MV-1        KVKLDSSCLTKHSAAQNIMFHAKAVNALFSPCFDEFKNRFMSCLKKHIVFFTEMDNRLFARVVNGL-VGSDDSDLHVGEVDFSKFDKSQDVFIKEFEREIYSL--LGFDSELLQ-   225
TV-1        KVKLDSTCLTKHSAAQNIMFHAKAVNALYSPCFDELKNRFLSSLKKHIVFFTEMDNRTFARVVNAL-VGSDDSDLHVGEVDFSKFDKSQDIFIKEFEREVYTL--LGFDEEMLQ-   225
ReV-1       KVKLDSTCLTKHSAAQNIMFHAKAVNSLFSPCFDEFKNRFMCSLKKHIVFFTEMDNRSFARVVNAL-VGSDDAGLHVGEVDFSKFDKSQDIFVKEFEREVYLL--LGFDEELLQ-   225
BYV         KVKLDSSCLVKHPPAQNIMFHRKAVNAIFSPCFDEFKNRVITCTNSNIVFFTEMTNSTLASIAKEM-LGSEH-VYNVGEIDFSKFDKSQDAFIKSFERTLYSA--FGFDEDLLD-   224
AV-1        KVKLDTSCLSKHPPAQNIMFHRKLVNSIYSPCFDEFKNRVISALNDNIVFFTEMTNRQMAQIAENK-LGTNG-DYFIGEVDFSKFDKSQDAFIKAYERTLYKF--FGFNDELLD-   224
BYSV        KVKLDASCLVKHPPAQTIMFHRKAINAIYSQCFDEFKNRVLSCLSPNIIFFTEMTNQKFADIASNL-LGFEN-VFNIGEIDFSKYDKSQDAFIKSFDEALYEEFGFGFDPELLS-   226
GLRaV-2     KVKLDSSCLTKHSAAQNIMFHRKSINAIFSPIFNEVKNRIMCCLKPNIKFFTEMTNRDFASIVSNM-LGDDD-VYHIGEVDFSKYDKSQDAFVKAFEEVMYKE--LGVDEELLA-   224
BcLRaV-1    KVKLDASSLVKHPPAQNIMFHRKVVNAVYSQCFDEFKNRLIYVLKDNIKLYTEMSLGSFGDMVGSM-LGYTC-DYNVGEVDFSKFDKSQDKFIKAFERRIYES--FGFEAELLD-   224
BVA         KVKLDSSCMSKHSPAQNIIFHNKVVNLIFSPIFDTIKSRILYCLNPNILFYVDMNEEELAEWVYRR-IGGED-IYYKAELDFSKFDKSQDFYIKAYERFMYQA--FGFDPELLD-   224
AcV-1       KVKLDASSLTKHNPAQNIIYHIKFINAVFSSIFAQLSERLRVVLKRNIILYTSMSVDKFADRLYDV-LGGTN-VYNTVEMDFSKFDKSQDVYIKACEMEIYRR--LGMSEDMLD-   224
PeVB        KVKLDSSSLSKYPPAQNIIYHSKLVNSIFSPIFSELQRRLIASLNDNIIVYTGMAPNVFARKLTRL-VGNGQ-DMHVGEIDFSKYDKSQDEYIKAFELEFYSL--FGITAEMLD-   221
ArPV-1      KPKLDVGHFGKYSPTANIVYFEHMINMFFSPIFLEIFGRIKYCLNDNIILYCGLNLDDLSKLIKSK-LRQPLDTYHFCELDFSKFDKSQGQVIKFYEALVYKF--FNFSGNEYD-   222
CoV-1       KPKTDTSGYIKYAQPANIVYYQHVINMFFSPIFLEIFSRISYCLRPNVVIFSGMNLDELAEVIQTR-LRFPIDSYYCCEIDFSKFDKSQGVIMKMYEEIVYKF--FKFSPNVYD-   222
LCV         KPKMDMSSYSTYDPPANIVYYQHIVNLFYSPLFLEIFDRITYCLSSKVILYSGMNLETLADLIAAN-LTMPINCYKTTEIDFRMFDKSQGVLFKVYEEMVYKT--FKFSEEMYD-   222
LIYV        KPKMDLSTYDSYNAPANIVYYQQIVNLYFSPIFLECFARLTYCLSDKIVLYSGMNTDVLAELIESK-LPLGLNAYHTLEIDFSKFDKSQGTCFKLYEEMMYKM--FGFSPELYDR   223
GLRaV-1     KPKLDSTPLQQYITGQNIVYHDRAITAMFSHIFTQAVERLKYVLHTKVLAYHGMSTEDFSREVGDR-LGDVS-GYYVYELDISKYDKSQGACMKDVERRILIG--LGVSESVVD-   224
GLRaV-4     KFKGDSEALEEFAPGQNIILHDRLTCAHFSSVFCELVNRLRCVCLPNIILFNGLSFEELQRLSTQLWVGSHWQTFKCDEVDISKYDKSQNTFTKAVELEVYRR--LGLDQNILD-   226
              * *      .   .*: . :      :*  *     *.      ::  :  :    :        :          *:*:  :****.   *  :  .     : .  .

FiVA        MWMRGEKFGHAKTLDGSLRFNVINQRRSGASNTWIGNTLVTLSILCMYYDIRKFPLILVSGDDSLIYSY--------------------------KPIKNYATNVCNEIGFEMKF   313
FiVB        IWMRGEREATARTIDGRLKFSILNQRRSGASNTWIGNTLVTLGILCMYYDIRKFPLILISGDDSLIYSY--------------------------EPVKNFATQISNELGFETKF   313
RLMV        MWMEGEYNAYASTMDSQLSFRIENQRRSGGSNTWIGNSLVTLGLLSMYYDVSKFRLLLISGDDSLIYSD--------------------------EKIKDHSSQICLETGFETKF   313
RLRaV       LWMYGEYRAHATTTDGSLSFDVKNQRRSGGANTWIGNSIVTLGILAMYYEVDRFKLLTISGDDSLIYSN--------------------------TKIANHSTQICLETGFETKF   314
CTV         VWMEGEYRARATTLDGQLSFSVDGQRRSGGSNTWIGNSLVTLGILSLYYDVSKFDLLLVSGDDSLIYSS--------------------------EKISNFSSEICLETGFETKF   313
SCFaV       VWMQGEYSAKATTLDGSLSFSVDNQRRSGGSNTWIGNSLVTLGIIALYYDVSKFRLLAISGDDSLIYSD--------------------------NKIANFATEICLESGFETKF   313
CYLV        LWMQGEYQGKATTLDHQLSFNVECQRRSGAANTWIGNSVVTLGILSLYYDLAKMQGVFISGDDSLIFSS--------------------------QKLSNHSEAICLETGFEAKF   314
CNFV        LWMQGEYRAKATTLDGQLSFDVVNQRRSGASNTWIGNSLVTLGMLSLYYRVNDFKALFISGDDSLIYSE--------------------------TPITNHADAICIETGFETKF   314
MV-1        LWMEGEYAAKATSLDGKLSFDVKNQRRSGASNTWIGNSVVTLGVLSMYYRVDELSALFVSGDDSLMYSR--------------------------SPIRNHAEAICIETGFETKF   314
TV-1        LWMEGEYSAKATTLDGKLSFEVKNQRRSGASNTWIGNSIVTLGILSMYYKVDELLALFVSGDDSLMYSN--------------------------KPIANYAESICVETGFETKF   314
ReV-1       LWMEGEYSAKATTLDSKLSFEVKNQRRSGASNTWIGNSVVTLGILSMYYKVDELLALFISGDDSLMYSH--------------------------KPIANHAEAICAETGFETKF   314
BYV         VWMQGEYTSNATTLDGQLSFSVDNQRKSGASNTWIGNSIETLGILSMFYYTNRFKALFVSGDDSLIFSE--------------------------SPIRNSADAMCTELGFETKF   313
AV-1        IWMEGETHSEARTLDGQLKFTVKNQRKSGASNTWIGNTIVTMGILAMYYDIRNLESLFVSGDDSLMFSR--------------------------KPIANVADDICLDLGFETKF   313
BYSV        VWMEGEYRSERNTMDGQVGFTVDCQRKSGASNTWIGNSVVTLGILAMYYDVSKFQALFVSGDDSLIFSA--------------------------DEIANYAEDICLELGFETKF   315
GLRaV-2     IWMCGERLSIANTLDGQLSFTIENQRKSGASNTWIGNSLVTLGILSLYYDVRNFEALYISGDDSLIFSR--------------------------SEISNYADDICTDMGFETKF   313
BcLRaV-1    VWMEGEYLGKARTLDGQLGFQVENQRRSGASNTWVGNSLVTLGILSLYYDVEKFDALFVSGDDSLIFSR--------------------------NPIKNYSDTICLETGFETKF   313
BVA         IWMEGEYHCRAMSRDRDLAFTLSAQRRSGGSNTWIGNTLVTLGLLCMYYDLSKANAVLLSGDDSIIFHS--------------------------REIPDTSEEIITDTGFETKF   313
AcV-1       LWCAAETFCKARSLDKDVSFTLGAQRRSGTANTFLGNSIVTLLLLSQYYDIEDMSCLAVAGDDSIMFAAADAVFANCDIGPKFGGGTHDILFSKGKPIPDFSHELMVDLGMETKL   339
PeVB        LWSAAEYFCNARVTGGALSFKLQTQRRSGGANTFLGNTIVNLMILSLYYNLPLVDAVCVAGDDSVMYSR--------------------------EDIVNHAQRMVNDIGMEAKF   310
ArPV-1      NFALSEFFCNATASCG-VNVDLFCQRRTGSPNTWLSNTITTLAMLASVYDFADFDCILVSGDDSLIISK--------------------------DPIPNKSLDLNEMFGMECKY   310
CoV-1       NFKISEYFVKARSASG-VKVDLFAQRRTGSPNTFLSNSIVTLGLISNYYDLDDFDLVLVSGDDSLLLSR--------------------------KPIPNQTNFMNKDFGMEAKY   310
LCV         NFKFTEYFTRYKGDCG-VSGELGAQRRTGSPNTWLSNTLVTLGILMSEYDLDDIELILVSGDDSLIFSK--------------------------HDLPNVTAEINRDFGFEAKF   310
LIYV        DFKYTEYFCRAKATCG-VDLELGTQRRTGSPNTWLSNTLVTLGMMLSSYDIDDIDLLLVSGDDSLIFSR--------------------------KHLPNKTQEINKNFGMEAKY   311
GLRaV-1     AFFCGEYDSVVTMGKNELVLSVGAQRRSGGANTWLGNTLVLMTLLAISLKGSEPSLVVVCGDDSLIFSK--------------------------NELQIDDRILEESFGFDLKL   313
GLRaV-4     TWAASEFYGRATTSSKSFSAEIYAQRRTGAANTWIGNTVINMCLLAQSTDVEKFSACCFAGDDSLLVYR--------------------------NKPNIQFEVYETKFDFDVKF   315
             :   *           .   :  **::* .**::.*::  : ::             ..****::                                           .:: *

FiVA        MQNAVPYFCSKFLVQTGFRTVYVPDPYKLLVKLGGFQKH---LTPKELFEVFVSFRDLTVEFDDQIVLERLALLVQKKYEFESGTTLPALCSIHCVRSNFLSFCKLFPHYFGFSY   425
FiVB        MPNAVPYFCSKFIVQTGNRTVFVPDPYKLLVKLGSNSKY---LTPKELFEVFVSFRDLTIEYDDQIVLERLTLLVHRKYNFESGFTLPALCAIHCLRSNFSSFLKLFPSFTGFQY   425
RLMV        LSPSVPYFCSKFVVQTGSMTYFVPDPYKLLVKLGGSTPF---VTDVDLFEAFVSFRDLTRAFDHQVMLERLCGLVHTKYCFTSGSTLPALCAIHCIRANFSSFKKLYPKTVGWWL   425
RLRaV       MTPSVPYFCSKFVVHTGSFTYFVPDPYKLLVKLGAPSKY---ITDAGLFETFVSFRDLTRDLNNQLVVERVAMLVEEKYNFKSGFTIPAICALHCLRSNFLSYSKLFPVQRGFFN   426
CTV         MSPSVPYFCSKFVVQTGNKTCFVPDPYKLLVKLGAPQNK---LTDVELFELFTSFKDMTQDFGDQVVLEKLKLLVEAKYGFASGTTMPALCAIHCVRSNFLSFERLFPFIRGWYV   425
SCFaV       MSPSVPYFCSKFVVQTGTNTVFVPDPYKLMVKLGASNKF---VTNEGLFEVYTSFRDLTKDYGNQIVLERLKHLVEKKYNFESGTTLPALQALHCLRSNFMSFARLFPRISGWWM   425
CYLV        MSPSVPYFCSKFLVFCEHKFFFVPDPYKLIVKLGQVRSE---VEDADLFEIFTSFKDLTKDMHDERVLEYLARLVEEKYDVKSRCVLSALHAVHCLGSNFSSFKKLFPKQKGWLT   426
CNFV        MTPSVPYLGSKPGVCCGHKTYVVPDPYKLMVKLGSVRKE---VDDSELFEVYTSFKDLTKDFDDERVVRKLSLPLASKYGFDSVHCLPALHSIHCLNSNFKSFLKLYNRKSGWFT   426
MV-1        LSPSVPYFCSKFVVHCGHKTYFVPDPFKLMVKLGAVRNE---LTDKDLFEVFTSFRDLTKDFDDERVLVKLNYLLESKYGKVSAFALPALRSIHCLASNFSSFVKLFDKSCGWVV   426
TV-1        LSPSVPYFCSKFVVHCGFKTFFVPDPYKLMVKLGSVRKE---LTDKDLFEVFTSFKDLTKDLGDERVLEKLNLLMIAKYGYNSDFALPALRSIHCLASNFSSFSKLFEKSTGWVV   426
ReV-1       LSPSVPYFCSKFVVHCGFKTFFVPDPYKLMVKLGAVRKE---LTDRDLFEVFVSFKDLTKDLGDERVLEKLNYLMMAKYNCNSDYALPALRSIHCLASNFSSFSKLFELSSGWIV   426
BYV         LTPSVPYFCSKFFVMTGHDVFFVPDPYKLLVKLGASKDE---VDDEFLFEVFTSFRDLTKDLVDERVIELLTHLVHSKYGYESGDTYAALCAIHCIRSNFSSFKKLYPKVKGWVV   425
AV-1        MTPSVTYFCSKFFVFCDHKVYFVPDPYKLLVKLGQAREE---VDDADLFEVFTSFKDLTKDYDDQRMIDKLTELVHEKYNFISGNTTPALCLIHCLRSNFKSFKKLYTKSSGWKI   425
BYSV        LTPSVPYFCSKFLVFTGDKCVFVPDPYKLLVKLGASGRR---LSDEELFEVFVSFRDLTKEFGDERVLNTLSELVHLKYEFEWGNTKLALSTIHCLRSNFLSFSKLFVKRTGWKV   427
GLRaV-2     MSPSVPYFCSKFVVMCGHKTFFVPDPYKLFVKLGAVKED---ASMDFLFEVFTSFKDLTTDFNDERLIQKLAELVAVKYEVQTGNTTLALNVIHCLRSNFLSFSKLYPRVKGWQV   425
BcLRaV-1    MTPSVPYFCSKFLVFTGNRVVFVPDPYKLLVKLGAPLKD---VSVDYLKALYESFKDLTTDFDDQVVIDLLTELVHLKHNFCSVYTNTAICSIHCLRSNFKTFRRLYPEVRGWMM   425
BVA         IRDAPAYFCSKFIVFCGDYVCFSPDPYKLCVRLGKTLNI---RSYYELYERYISFRDVTRDYDDGVFIENLAPLVSRRYKCPLSEVYPALCSIHCARANFKKFREIYPRPSGYTL   425
AcV-1       YRDLPAYFCSKFIIFCNERIYVIPDPYKLMVKLGKPYND---WDDSVLNERFISFKDHTKHLDNESVVAALTEAVNIRYNLVGYHTYAAISALHCVSANKKRFFELYPFKHGFLT   451
PeVB        IKNSYGYFCSRFLVPAGDRIYFVPDPYKFMVKLFKPTPI---YNDVELRERYISYKDNCTAFGNEGVVSRLVDLVNDRYKIEGKHTYSAIASVHCILANYSRFRSMYPISWSFIN   422
ArPV-1      LPNPTPYFCSKFIIQVDEEIVIVPDLVRLYEKLSNPISTFDKEHPTLLRERFTSYRDLLDAYFDDTTYLKMDSYLTKRYNIPEFSGYAAFCFVHVLFSSVKNFTKLLYSDHEVLI   425
CoV-1       LDHPTTYFCSKFIFNDGENIKILPDPVRFFEKLSVPILEENLENQSLLRERFISYRDLMKEYFCESYIVKIDLLLMKKYGIPYFSSYSASSNIHILLSSFKNLLKVFEGGDRCMI   425
LCV         LMNSVPYFCSKFIYCDNGRVRVTPDAQRMFEKLSTPIRRRDFEEGTILKERYTSYKDLMYDYMRDTTCIHVDQMLSIRHNIPPMSSYAALCYIHCMYANMVAFKKLWDERFSVNV   425
LIYV        IEKSSPYFCSKFIVELNGKLKVIPDPIRFFEKLSIPIRQEDFVNGSVVKERFISFKDLMKEYDNDVAVIRIDEAVCYRYSIPVGCSYAALCYIHCCMSNFVSFRRIYDNCEIVWI   426
GLRaV-1     TCQCAPYFCSKYLVRTPDHCYFLPDPFKLFLKLSLERE----PNEDLLFEVFTSFVDLTRGFGDESAVQQLVAMDAQRYG-PNPYAYAAFCLVHILAANFVQFKRLFYDADGVFG   423
GLRaV-4     FDSAAMYFCGKFLVTDGSKTHVVPDPLKLFVKLGKERP----TSDKVLKENWRSFFDVTKAFNNNTVLENLVDQFALKYS-RSNNAYAAFCAVNSLRSNPEQFKRLWFSLYNPIS   425
                  *: .:            **  ::  :*              :   : *: *             :      ::         *   ::  :.       :
```

```
FiVA      LSKFQVYAFSKI-------PNSVV-RLFNGSDSGY-NYIGTVFGEFDNPQEPWESANDVFKGVKFSRRSGGRNSKNFRRKLQHLPDQFKSSG-KDVLRADRAKG---FYMRSKYE   527
FiVB      LHRSQLRFFSLI-------PNSFV-SVLSTSDRAY-QFLGFVIGEEETPSSEWVACANVTHRVK-TKNPKKYFQKNVRRRIRSLPERMRSSAFREVMNDCKSNN---FHEFLRKR   527
RLMV      VTSSRLKFLSKL-------PGLIV-SKAFSSTGESNYFCYLRDSFA---------------------------------------DDPG--------------------------   467
RLRaV     STYSEIRSLRRL------VPGLLV-TAYRCAGEKR-YFSYLKSSID---------------------------------------EDPPPLA--SVVKSY---------------   477
CTV       VDALKLRQLRKL-------TNLIC-ERVVYDNRVS-YFSYFDNPFT-KPDANDDNV-----------------------------DDLGQAG--ELATG----------------   483
SCFaV     VDPRNLKFFVKL-------PGIII-ERVNEERDSR-YFVSLLDSAEATVVS----------------------------------QD----------------------------   469
CYLV      FSRVSKSLLQKI------SLGVLQQEKYSTAFGEN-YFLSYTS------------------------------------------DDA---------------------------   465
CNFV      VKKLLPNLKRLI------FQGKLN-CAKVSHF-------FW--------------------------------------------------------------------------   453
MV-1      VPKINSYFKKLI------SLGAYH-EKFVTPFGEQ-YFISW--------------------------------------------------------------------------   459
TV-1      VPKLNSYYKKLI------ALGAYN-ERYVTPFGEQ-YFVAW--------------------------------------------------------------------------   459
ReV-1     IPRMNSYYKKLV------NLGAYK-EVYQTPFGEQ-YFIAW--------------------------------------------------------------------------   459
BYV       HYGKLKFVLRKF-------ANCFR-EKFDTAFGER-TFLLTTKL-----------------------------------------ETVL--------------------------   464
AV-1      FYGRLSKYFKSK-------MNVTK-ERFQTPFGEA-WFLSTELGE----------------------------------------------------------------------   461
BYSV      VYGKAKYILKKF-------LGYNI-EPITTTFGDA-WFVYKE-------------------------------------------------------------------------   460
GLRaV-2   LYTSVKKALFKS-------GCSFF-DSYMTPFGQA-VMVWDDE------------------------------------------------------------------------   459
BcLRaV-1  VSAISNLMRKIL-------PDFVV-RKYPGVAGVSIEFLSDLNSSDPHPFRN--------------------------------PESV---------------------------   473
BVA       VRGYTHLILLLK-------HGYKVYEERKVAKELR-SYVGFAVQ-------------------------------------MYLPDDDCQKL--CDLTTLRAQHGRISYLNSSRG   493
AcV-1     RSVRKVSRLLSKFAYYIKLKGFVIIDKRDQGDTYA-FDYAFRETYE----------------------------------ARNNPDVFGKPI-----------------------   508
PeVB      VWHLAGAKLMDK-------LGFEKIHENESKDVFV-YSKHYGWL-------------------------------------HHKTDEELKCM--SDLSESR-------YAKVTRK   483
ArPV-1    -------------------------------------------------------------------------------------------------------------------   425
CoV-1     -------------------------------------------------------------------------------------------------------------------   425
LCV       -------------------------------------------------------------------------------------------------------------------   425
LIYV      -------------------------------------------------------------------------------------------------------------------   426
GLRaV-1   KNSKSKATR----------------------------------------------------------------------------------------------------------   432
GLRaV-4   ------------------STGVFK-------------------------------------------------------------------------------------------   431

FiVA      RKQERQSIFEG-------------------------   538
FiVB      RV----------------------------------   529
RLMV      ------------------------------------   467
RLRaV     ------------------------------------   477
CTV       ------------------------------------   483
SCFaV     ------------------------------------   469
CYLV      ------------------------------------   465
CNFV      ------------------------------------   453
MV-1      ------------------------------------   459
TV-1      ------------------------------------   459
ReV-1     ------------------------------------   459
BYV       ------------------------------------   464
AV-1      ------------------------------------   461
BYSV      ------------------------------------   460
GLRaV-2   ------------------------------------   459
BcLRaV-1  -----------------------------------F   474
BVA       CKEKKMSKLEKRSA---RKLAVDVDYVSNRICAEYS   526
AcV-1     ------------------------------------   508
PeVB      AEKYLNPRFKKHIVKLLRKMELKGGF---RLTDEG-   515
ArPV-1    ------------------------------------   425
CoV-1     ------------------------------------   425
LCV       ------------------------------------   425
LIYV      ------------------------------------   426
GLRaV-1   ------------------------------------   432
GLRaV-4   ---------------------------------RGE   434
```

Fig. S2. Alignment of hypothetical ORF2 protein sequences of FiVA and FiVB.

```
FiVA  MI-RPRFLCSETRLGVHVFITCSLRHNGFVLSLRNCEYETVFHDEMISIESVDNDVKISSLLSNSDRSYYFHFIIKTTIEFYTHNIDVKTSGSVNLSFALESL   102
FiVB  MTSNENSLSAPRSFRAHMFIAFKPSLGRFKLSIFSPNAVVVLGDSHVTIANLQNCTVIESISDRIDTYCVVHVEYCVAVDLYQHSFDFNTSGFVCLSLSLEDL   103
      *  . . *.:   : .*:**: .   . * **: . :  .*: *. ::* .::* . *.*: .. *    .*.   .::::* *.:*.:*** * **::**.*
```

Fig. S3. Alignment of hypothetical ORF3 protein sequences of FiVA and FiVB

Predicted transmembrane domains are marked in green

```
FiVA  MAEHFEDKTSRDDLKRFMYLCEECFEEHLEIEFLSDSLPDDSSLKITLTDSHDVKNSICLLAYRYDSNTILVALFDNKNQEFKKDHTTSLINGNYVKITLKRERDSVQVVMSGKI   115
FiVB  M--------TTEQISRHFIAVDEDLKENLDFSFNISNLPVDSSLKMTIFDPTDLKNSICLLFTKYDDATILAALFNDKEQEFKKDHTTTMIRNVAVSVSIYRTSEGVEIFQESIK   107
      *        : :::.*.:   :* ::*:*::.*  ..** *****:*: *. *:*******  :**. ***.***::*:*********::*..  *.::: *  :.*::. ..

FiVA  ITVVNAEKVKLMLSTWSTADCEIDFSKCVLLSRSLNDVGDRLDDLVEKFPKTPNNEYVRREYAKRKTFTKLSLKIYFTFVLLSVIVVLLVVATVLSVASE   215
FiVB  VAQVIAKKLKLIISVWSDVDVERDFSENVTLSRRLHN-SNAVESDDKLFPQTPDNKFVRRELVKRQQIQNYNIRILAALLLLLVCVVLIITLSITT--PD   204
      :: * *:*:**::*.** .* * ***: * *** *:: .: ::.  : **:**:*::**** .**: : : .::*  :::** * ***::. :: :  .:
```

Fig. S4. Alignment of p6 protein (ORF4) sequences of FiVA, FiVB, and related viruses

Predicted transmembrane domains are marked in green.

```
FiVA   MMDCVVQGYLTFLLGSGIFIG---LVF-VVYVLYVLNKLVKNKGEIKQFSSPHPTELP-----GFSHGGR    61
FiVB   -MDCVVQGYLMFLLGSGIFIG---LVF-VCYVLYVLNKLVKNKGEIKQFSSVPSREIP-----GASYANH    60
FMMaV  -MDCVIQGYLTLLMGCFVFLF---KAF-IAYVLISFRHLV---GLPKPSATSHPDYPPP------GSGVR    56
RLRaV  -MDCAERSFLDFTIG-VVCLFVTGLVIAFFLYLYKTRKIVGQFAARRDLREPQPARALN---GGGFAAVV    65
CTV    -MDCVIQGFLTFLVGIAVFCAFAGLII-IVITIYR--------CTIKPVRSASP---------YGTHATV    51
MV-1   -MDCTLRAYFYLLLGWIIVCFSFTLGF-VVYKLVRTCSNV--YGDIIDTSVVGTSRRIDIENRGNSSARV    66
BYV    -MDCVLRSYLLLAFGFLICLFLFCLVV-FIWFVYK-------QILFRTTAQSNEAR-------HNHSTVV    54
        ***. :.:: : .*  :        . .   :
```

Fig. S5. Alignment of heat shock 70-like protein (Hsp70h) (ORF5) sequences of FiVA, FiVB, and related viruses

Hsp70h domain sequences used for the phylogenetic analysis are marked in yellow

```
FiVA         MAE-DKTYFGLDFGTTFSTI--SLLTKGGV-LVYKQKGSEYIPTTLFI-PEDEKYVMYGHAAE-SAYVTGVKGSYYKDLKRYVGCNSR--NISRYLELMKPAYEVTTSKIG-NSQ    106
FiVB         M----TTYFGIDFGTTYSTV--SLLTKGGV-LIYKQNGSAYIPTTLFI-SEDEKTLKYGFDAE-EAYVKCETGKYYRDLKRYVGCNDR--NLDTYLSLLKPKYDVSTEKVG-DSE    103
FMMaV        -----MATFGLDFGTTFSTV--SVVTSSGY-LFFQQNDSAYIPTSLFF-FPS-GGVCFGYQAD-KNFISKADGSYFRDLKRYVGCTSR--TIGNYLTKLRPHYRVTPVKVG-YGV    101
RLMV         -----MVVFGLDFGTTFSTV--SVLVGRDA-CLLLQCGSAYIPTTLFF-PESTTNVYYGYDAD-FMHRSKAKGAYFRDLKRWVGCNSS--NIGEYRAKLHPSYELDLRKVG-DSE    102
RLRaV        -----MVVFGLDFGTTFSTL--ALATDTEY-VLLKQSDSAYIPTALFLPSSNTTDAYYGYDAE-YANRSGAPGWFFKDLKRWVGCTEK--SVTKYVDKLSPSYSIKVTNLG-NSA    103
SCFaV        -----MVVFGLDFGTTFCTL--SVCCSKEI-VLLKQNGYSFIPTTIFL-CLD-DTVLYGYDAD-YAHASGWSGFYYKDLKRWVGCTDK--NFYTYMDKLKPDYEARLSLVG-KGT    101
CTV          -----MVLLGLDFGTTFSTV--AMATPSEL-VILKQSNSSYIPTCLLL-HAEPNSVSYGYDAE-YLAASGESGSFYKDLKRWVGCTAK--NYQTYLHKLSPSYKVIVKEFG-TKS    102
BcLRaV-1     -----MVLFGLDFGTTFSSV--CVYNDGDI-FMFKQNDSGYIPTSIFL-PDASKDIKFGYDAE-LAFKRKLKGLYYRDLKRWVGCCED--NLDTYVKKLKPSYAVHLMHYG-DGT    102
CYLV         -----MVVFGLDFGTTFSTI--SVLKEGEI-YLRKQQNSPYIPTYIFL-SEETAEVAYGYDAESLMYSRKIKGSFFRDLKRWVGCNEK--NFEKYMSLLKPSYKVELSLFG-SSD    103
CNFV         -----MVVFGLDFGTTFSTL--SVLKNNEV-FLLRQQDSSYIPTYVFS-FEESREVAYGYDAETYNLKSNIKGSFFRDLKRWVGCNED--NFARYYNKLQPSYSVNLTSFG-QSL    103
MV-1         -----MVIFGLDFGTTFSTL--SVLKANEV-FVLKQNDSPYIPTYLFF-YKNSREVAYGYDAERLLHSKGSEGGFFRDLKRWIGCTER--NYASYLEKLAPSYTTSIDSSIDNCD    104
TV-1         -----MVVFGLDFGTTFSTL--SILKGREV-YVLKQNDSAYIPTYLFF-YEKSPEVAYGYDAEKLSHDSNVRGGFFRDLKRWIGCTQS--NYPEYKKKLSPTYYTSMDTRMEGCD    104
ReV-1        -----MVVFGLDFGTTFSTL--SALKGKEV-YVLKQNNSAYIPTYLFF-HDFVRNVAYGYDAEKLAHDRSVRGAFFRDLKRWIGCTEN--NYLEYKAKLDPKYHTSINSRVDGCD    104
BYV          -----MVVFGLDFGTTFSSV--CAYVGEEL-YLFKQRDSAYIPTYVFL-HSDTQEVAFGYDAEVLSNDLSVRGGFYRDLKRWIGCDEE--NYRDYLEKLKPHYKTELLKVA-QSS    103
BYSV         -----MVVFGVDFGTTFSSV--CVFNSGRL-HVFKQQNSAYIPTCLFL-YSDTMAMSFGYDAETASLDPNVKGGFFRDLKRWVGCDET--NIEEYKSKLKPHYSVTLSNFG-KGS    103
GLRaV-2      -----MVVFGLDFGTTFSTV--CVYKDGRV-FSFKQNNSAYIPTYLYL-FSDSNHMTFGYEAESLMSNLKVRGSFYRDLKRWVGCDSS--NLDEYLDRLKPHYSVRLIKIG-SGL    103
AV-1         -----MVLYGLDFGTTFSTI--CFYHDNSV-VALMQDGDTNIPTYLFF-HSDGARVSYGRDAELCVSGNRSKGGFFRDLKRWIGCEKA--NLDKYIKDLKPHYRVTTTNASFGGT    104
AcV-1        -----MTIIGIDYGTTFSTC--SIVTSTSV-LILQHNDSEYIPSLIAI-SNKSGAITIGFDV--ISKESDTSYSCYKDMKRWVGVDVS--SYAERELKLKPTYDTKPGENM----     98
BVA          MSSCGSVCYGLDLGTTYSTIG-CLVDRNSV-AMSCDCGSVFIPSVVAV-KGT--NFLVGNAAY-NVAYNDDSWSLFKDMKRWVGCTQDDITLEKYKESINPHYQVGFRANG----    105
PeVB         -----MVILGLDFGTTFSTL--SLITKTSV-CLALQSDSEFVPTTYGV-NDT--IDEYGYQLCDDKFNFKPGKSYYRDIKRWIGVTSK--TVESKRQQLKPDYIVKAGDTV----     98
ArPV-1       -----MVLAGLDFGTTYSSI--ASVSREES-LVLSLNGTPYIPTILAI-VDN-NKILVGEGAK-TVKNYSNNYSLFYDLKRWVGVTAL--NFDVLKAKLSPKYQCTFKKGD----     98
CoV-1        MPT--FCRAGVDFGTTFSTI--SAFVDEVA-TPLFLEGSPFIPTVITF-FDN--KVVIGELAK-TISEVVKDNVTYFDLKRWVGVNEK--NFIKLKEKLQPSYECKLEKGE----    100
LCV          M----AAKAGLDFGTTFSTI--SAYVNGQM-RVLKLNDTEFIPTCLAI-TVT-GDVVVGGPAQ-VLEGGEVANCYFYDLKRWVGVDKV--NFDIIKQKIKPQYSAVLVGND----     99
LIYV         MR---DCKVGLDFGTTFSTV--STLVNNSM-YVLRLGDSAYIPTCIAI-TPG-GEAIIGGAAE-VLSGDDTPHCFFYDLKRWVGVDDN--TFKFAMNKIRPKYVAELVEGE----    100
GLRaV-1      ------MEVGLDFGTTFSTACFSVPSEDDS-GCVTLVNSPFVPTQVFI-GSD-MTYSIGHRAY-SDFVAGKPGGLYINPKRWVGVDGY--NFQAVKRKLNPEYEVKLSNGE----     99
GLRaV-4      ------MEVGIDFGTTFSTL--CFSAGRGVDGCVPESDTIYIPTVVGI-RND-GTYTIGLGAL-----LEKDVLVYRDIKRYFGMNKF--NANTYMMKLRPKFEVLVKDWS----     94
                      *:* ***:.:   .              .   :*:              *                : : **:.*      .       : * :

FiVA         TDSAVIEAYNKWPNSKRNLNDLISLFIKVIVCEVEVRLNVKCQGIILSVPAGYTCLQRAYMEECCKASGYRCVTIINEPSAASIATLSHLSPD--HHDLLVYDFGGGTFDVSCIS    219
FiVB         RSSALISAYNEIPNSKRELCVLIALYLKSLISSVEKQLNIKCDGIILSVPAGYTCLQRVYMEKCCSLSGYACVSIINEPSAASICTIPYLLEN--QHDVLIYDFGGGTFDVSCVS    216
FMMaV        SDTVSLSAYNEAGADTFDLPFLIATYVSRLIETAEEAFRCKCSSLIVSVPAGYSCSKRLFMEACVSLSGYQCRAMLNEPSAAAIAALPHLSPT--DSLLLVYDFGGGTFDVSLAT    214
RLMV         MHTVALTPYNGG-KAWYPLPDLIGLYVKCILSDAEKAFQTQCSGVICSVPAGYNSIQRAFTEQSVSRGGYPCVYMLNEPSAAALSSLPRLKPE--DHRLLVYDFGGGTFDVSAVT    214
RLRaV        ASTIMLTPYGQKEAPYFNLPDLIALYIKCICSDGERAFGVKCTGCVCSVPAGYNTLQRAFTEACVLLSSYVCVYILNEPSAAALASAPHLDST--DKRLLVYDFGGGTFDVSAVT    216
SCFaV        LKTVELPSLSNT-KRYIPLPELIALYTKCIVKDAERAFTLTCTGVICSVPAGYNTIQRAFTEQSISRSGFPCVYMLNEPSAAALASAPMLKSE--DKRLLIYDFGGGTFDVSAVT    213
CTV          VPVPYLSPLNNDLGLSVALPSLIASYAKSILSDAERVFNVSCTGVICSVPAGYNTLQRAFTQQSISMSGYSCVYIINEPSAAAYSTLPKLNSA--DKYLAVYDFGGGTFDVSIVS    215
BcLRaV-1     LQTVSIDEYGGQ-AVNMRVPDAIAAYVRCILSAAEKAFGIECTGVVCSVPAGYNTIQRTFTQECVSLSGYHCSRIINEPSGAALSSIYDLEEE--DRQLLVYDFGGGTFDVSAVY    214
CYLV         LKTVKMHSFNPEGNYSYSLPDLIASFVRCIVYDAELCFKTKCTGIICSVPAGYNSCQRSFMLECVTLSGYTCLHIINEPSAAAFSAAPRLGPK--DKFVLVYDFGGGTFDVSGVS    216
CNFV         KQTVKLKAFNKQGAYTYALPDLIASFVRCIIKDGEDVFKTPCSGVVCSVPAAYNSVQRSFMMECVTLSGYNCLHIINEPSSAAFSASSSLSAD--DTFCLVYDFGGGTFDVSGVS    216
MV-1         FRIPMLNCFNSSCDMKLSLPDLVASFVRCIVTDGEKSFSVKCSGVVCSVPAAFTSTQRNFIMECVSLSGFHCSHIINEPSAAAFSAFRKLSPS--ERFVMVYDFGGGTFDVSAVS    217
TV-1         FNILVVGNYYNTIDLKLTLPDLVASFVRCIIRDGESTFDSKCSGVVCSVPAAFNSIQRNFIMECVTLSGYHCLHIINEPSAAAFSAFRKIPKD--MNFIMVYDFGGGTFDVSAVS    217
ReV-1        FRVLLMGDYYGTSALRMTLPDLVASFVRCIIRDGERSFDTTCSGVVCSVPAAFNSIQRNFMMECVTLSGYNCLHIINEPSAAAFSAFRKIPKD--MNFVMVYDFGGGTFDVSAVS    217
BYV          KSTVKLDCYSGTVPQNATLPGLIATFVKALISTASEAFKCQCTGVICSVPANYNCLQRSFTESCVNLSGYPCVYMVNEPSAAALSACSRIKGA--TSPVLVYDFGGGTFDVSVIS    216
BYSV         RKIPTLGSYSGSVQMSGSLSGLIALFIQALVKSAAIEFKCECTELIVSVPANCDCMQRLFTENCVNLSGFTCVHMMNEPSAAALSTCGRTDMS--ARNLLVYDFGGGTFDVSVLS    216
GLRaV-2      NETVSIGSFGGTVRSEVHLPGLIALFIKAIVGCAENAFACTCTGIICSVPANYDSVQRNFTDQCVSLSGYQCVYMINEPSAAALSVCNSIGRK--SANLAVYDFGGGTFNVSIIS    216
AV-1         LEVPVLESFSGSQNMSVPLPSLIASFCSCLVKALEKSSGTVCTGIICSVPANYNCLQRSFTQNSVTLSGYECVRIINEPSAAALVASQSIDDA--ETCLLVYDFGGGTFDVSAAT    217
AcV-1        -FDFELGAYNVK-GRLMPIRSLISLYIKALVKLFEIRCSVVCSGLVLSVPSQYTTSQRSFMVALASAIGIKIVHIMNEPSAALFASVSSIPNKVASEYYIVYDFGGGTFDVSIVG    211
BVA          --DLYLSASQGA-PLQLTLLSLLGLLVRGLVSLLESATRSSCDSLVISVPANFTILQRNFYTRITAVVGLKLQFVLNEPSAALICANYRRLNCESIRLVMIYDFGGGTFDVCAAS    217
PeVB         ---YDMFISDNNKSNFLPLYAVCAKFILCFIREFEYRREITCDGLVISVPAQYTSSQRLFMKSLETALGIPVVHIMNEPSAALFSAFRGLDATTINADYIVYDFGGGTFDVSLIS    210
ArPV-1       ---CYIVGEGNG-NFEASVKTLICEYIRTLIYLFQETFNVVVNAINVSVPADYTSLKRKYMKSILLQLGVPLNRIINEPSAAALYSIFSAPE---VGTTIVYDFGGGTFDSSIIQ    206
CoV-1        ---CYMGGIGVR-TVFRSVGFLIATYLDVLTKLFEEKYDVKITNLNVSVPADFYTFQRSYMRNAVNNLGIKVDRMINEPSAAALHSILSNPE---FTDFVIFDFGGGTFDVSYIK    208
LCV          ---VQLTGVNRGYSCTYTVKQLILLFIETLVRLFSKVENLNIVSLNVSVPADYKCKQRMFMKSVCDSLGFSLRRIINEPSAAAIYFVSKYAH---YDSFLMYDLGGGTYDSSLIV    208
LIYV         ---VYLTGINKGFSIKLSVKQLIKAYIETIVRLLASSYSLRVIDLNQSVPADYKNAQRLAARSVLKALSFPCRRIINEPSAAAVYCVSRYPN---YNYFLVYDFGGGTFDVSLIG    209
GLRaV-1      ---VVLGSVGNVNAPLVRVVDLVFLFVKGILLETEEAVGKAVSGVVCTVPAEYNSFKRSFLGVALEGLGKPLRALINEPTSAALYGAVRGGAL--KETYAVFDFGGGTLDISFIS    209
GLRaV-4      ---VSIGPVSGEKGKTRSVIALACMFVSALAKLAVSITGEAVTLSVCSVPAEYSSYMRNFIFQGCNLAKIQVQAVVNEPTAAGLSAFVAVDKE-SIEYMVVYDFGGGTFDASLMA    205
                  :            :          :                 :**:      *                ::***:.*                  ::*:**** : .

FiVA         VYGTSVVVTGSSSDMNLGGRDIDAALSSHLSKKCGL-TGQ-----FELQVTSLKEALCVSPNPIKFNLKPYK--DADVMVYPHEIAEIALPFIQRSVDTVRNLIES---------    317
FiVB         IYGTSVAVIGSGSDMNLGGRDIDAAFEKYLKDKHNI-DDT-----VKIPTTSLKEALSLSSSPVKFSARPCV--NDDIVVNSHELARVATEFIQRSINVMTQLIEE---------    314
FMMaV        VVGSTIAIKDSSGDMNLGGRDIDRALSDWIKSRAGV-ITP-----EPLDVSALKEALSISSETLTYTLDVAG--NPQVRISPSDLAEIARPFIDRSIAVVLKLLKS---------    312
RLMV         VNGTTFVVKGSGGDMNLGGRDIDRALSDHLKSLVSA-PVE-----WEIDVTSLKEALCSQPDSIMYNIPIQGNDEVKVELRSSDLLKISQPFVARTIKILQDVMVK---------    314
RLRaV        VAKSTFVVKASGGDMTLGGRDVDKALSDALKKRVGS-DYP-----GEIDVTALKEALSVQHQAVKFEVPKGT-GYVSTLVDMDLLRELSAPFINRTVDILEKTRKK---------    315
SCFaV        VEGATFVVKSSAGDMNLGGRDIDLALSNFLKKLAKS-DYV-----GELAVTSLKEGLSMAEGKIKYLVPSSN-GDVEVVVSTSMLNEICSPFIKRTLKIVEKVREK---------    312
CTV          VRLPTFAVRSSSGDMNLGGRDIDKKLSDKIYEMADF-VPQ-----KELNVSSLKEALSLQTDPVKYTVNHYG-MSETVSIDQTVLREIASVFINRTIDILTQVKVK---------    314
BcLRaV-1     RVDQTFTVGASNGDMNLGGRDVDRAFSDMIKSRANC-HAS-----GNIEVAYLKECLSKETEAIRFHFELEG-EAYDVHVSQEDLKMVAAPFIRRTVTLLEEVVKL---------    313
CYLV         VRNGTFGVRSSGGDMNLGGRDVDRSFVEKLYGKIGGLTPD-----YSLDVSALKERISSIGNPIVYQLPVGG-EFRSVEVDSSDLAEVALPLFQRTIKIMTKVHDDYYSSVSSND    325
CNFV         VRNNTFVVRSSGGDMNLGARDVDRTLVEMVYGRTSSHEVD-----YTLDVSSLKEKLSTLATPIEYPVPVKD-SFEYIMVSPEDLSRVIAPFIQRTVKITTEVYQKFLRAVEPTK    325
MV-1         VRNSTFVVKASGGDMNLGGRDVDRALLESIHEKAGVKHVD-----YTVDISSIKEKVSQALSSFVYDLPVGK-EFVSVLVTVEDVSKVVVPFIERTVKIMHSVYKSFIESSLDV-    325
TV-1         VRNNTFVVKASGGDMNLGGRDVDRALLEYVHRKAGVNNID-----YSIDISSIKEKVSNALTSFIYDLPVGE-KFVSVLVTVEDISKVVIPFINRTVNIMHDVYKNFVTATSQK-    325
ReV-1        VRSNTFVVRASGGDMNLGGRDVDRALLEFIHRKAKVGTVD-----YTIDISSIKEKVSSALTSFEYDLPVGD-KFVSVLVTVEDVSGVVIPFIERTIRIMHDVYKKFVTATSQS-    325
BYV          ALNNTFVVRASGGDMNLGGRDIDKAFVEHLYNKAQL-PVN-----YKIDISFLKESLSKKVSFLNFPVVSEQGVRVDVLVNVSELAEVAAPFVERTIKIVKEVYEKYCSS-----    320
BYSV         SLNQTFTVRASGGDMNLGGRDVDRAFKAKIYQMANL-PFD-----EEADISSLKESLSKIDYPITYTVKTKDGESKTVVVSRGLLAEVIVPFVDRTIKVMKRVFELYVKNMNLK-    324
GLRaV-2      YRNNTFVVRASGGDLNLGGRDVDRAFLTHLFSLTSL-EPD-----LTLDISNLKESLSKTDAEIVYTLRGIDGRKEDVRVNKNILTSVMLPYVNRTLKILDSTLKSYARSMNES-    324
AV-1         YVNNTICVKASGGDMMLGGRDVDAAIVDYLFRKLKR-PPN-----HKLDLSRLKEAISSTGQSVDYPIELDDGKETSVMVKYTDIADIAKPFIDRTVVVLRRVFSDFCAA-----    321
AcV-1        RETNYYGVILSGGDDALGGRDVDRAIRAFLENRFPV-KLS------DNDVSQLKEQVSRNGNNQSVTV-----SGTSVCLTYSDLINIIRPFLDRAGRVLADVYRD---------    305
BVA          ILSNTVVVSATGGDTFLGGRDVDNNIRRLLNNKYMT-ELM-----ECNDFSKLKEQVSKYMTKATSSLITWKRELIVVTLEFEELLTCCSPLIDKSLKHFDEVYLH---------    317
PeVB         KRGNVFSVILSGGDEVLGGRDVDKAIEGYIRDKYAL-AAY-----DSFPVVDLKIMVSTTFESTKIK----SNRGVVITLTPAELKEICLPFFNRASLILKSILEA---------    306
ArPV-1       KKGKIVSIVDTKGDLFLGGRDIDKSLATLIHSKTNT-EFD------FTILSLIKEEINNLNKF-SFTFVDKDHKPVSFTITPQEYRAILQPFIDRSLKILKDLIEV---------    304
CoV-1        KKGKIIMICDTQGDLFLGGRDIDKSIQHYFFGKYSI-EIH------PFSLSYMKEGVSTGKSQ-SFNVLSSNKEINHVNFSKDELNSIVSPFAKRSCEILKAVIDR---------    306
LCV          KDGKYVTVADTEGDSFLGGRDIDRAISEYIIKKYSL-KFPL----SADFLANIKEEANSSGRE-SFNVTDEKGKLMTVKLTREELDSCIQPFSDRSLRILENMVVR---------    308
LIYV         KYKSYVTVIDTEGDSFLGGRDIDKSIEDYLVGKYNI-KKVI----PATYLALIKEECNNTNKS-IFTILFDDGSVQVVEFSKSELEKCVRPFVERSIKLINDVVVR---------    309
GLRaV-1      RFNNVVSVLFSKGDNFLGGRDIDRAIVQFLRKEKRI-TGVIDAGILAVMIADLKEKICVNGGTQYTQVKTSN-GLETLSMSVDELNAVSEPFVDRAIKIFAEGANE---------    313
GLRaV-4      VGSSYVCVVDSLGDNYLGGRDVDNALLEVVMKTLAL-TDK---DLDPFSMEALKIDMVENPSSVVRRVLTNSGEVRIFNYDSSKFRELCSPFVEKARMIIEKLLSR---------    307
                    :  : .*  **.**:*  :   .                      :*                                        ::
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FiVA      --------LGF-SHKKYDIALVGGSSSLPGVKSILSSL--YFCNKV-VPFENSRAAVSIGCSIYAKAFDSNSQLILIDATSKDLGLASNKGNMLLLAPRAAPLPFNGKTSVTCPG   420
FiVB      --------LNF-NNKKFIITLVGGSSNLPGVKGLLKNL--YFCDNI-LDLPDSRAAVSVGCALYSKAFDSDASLILVDAASKDLGIASNKGNMLVLAPRAAPLPFNGVTSITYPQ   417
FMMaV     --------SKF-RSLKPKVVLVGGSSALPGLSQLITQM--PSFSGV-VEVPDARGAVSAGCALFVRSFDATSDMHLVDCVTVSVSVCSLRGMAVCIVPKGSPLPFVGSKSITLEN   415
RLMV      --------AKF-VNEPSKVVVVGGSSKLPGLEGSLLSI--KGISAV-VPLPDHRAAVSLGCALYSNCLSDSHSLLMVDCATKSISIPRYDGASIVVIPAGSPIPFDGERTIGMMG   417
RLRaV     --------AGFLKTDDVKLVVVGGSSTLPGLKETLGKI--LGVVGV-VSLADHRAAVACGCALYARGISTDSSILMVDCATSNISISSYRGDSIVVIPAGSPIPFDGERDIEMLN   419
SCFaV     --------ARFSAEHGAKVVVVGGSSTLPGLCDELNAV--HGISGL-VRLLDHRAAVSYGCALYAKCLTSASNVLMVDCATSNICLPGTCADCIVVIPSGAPIPFDGERTIHINN   416
CTV       --------SSMPESQSLKLVVVGGSSYLPGLLDALATV--PFVSGI-VPVEDARTAVATGCALYSECLDGRSKALLIDCITHHLSVTTFSADSVVVAAAGSPIPFEGEQKLTLRK   418
BcLRaV-1  --------AGFTGERNTTLVVVGGSSYLPGLHEELKKF--LVVRKI-VPIPDPRGSVAIGCALYADSMQSPNGLLLVDCASQSIGIADYRCKMMRVCAAGSPIPYVGEKQIMLVD   417
CYLV      KIPRSGKEKKETSDDGCVLITVGGSSYLPGLKGLLSAI--PYVSRV-IELPDARSSVAAGCAMYSLCLAKDSSMLLIDCASHHLSIPSYQCESIVLVPAGAPIPFSGRRTISLMN   437
CNFV      RV-----GEKMSSESKCVLVAVGGSSYLPVLSNILTSI--PYVKRV-IELHDARAAVSIGCAMYSLCLSENSPMLLVDCAAHNLSIPDYKLESIALVPAGAPIPFSGRRTISLQN   432
MV-1      --------STMNHDRKCSVVTVGGSSYLPGLKNVIEAI--PFVNRV-VEVPDARSAVSAGCALYSLCLSSNSSMLLVDCATNTLTTPSYTCETIVVVPKGAPIPFSGKRKIFLSK   429
TV-1      -------GVRKEHHRKCGVIAVGGSSYLPGLLGVLSAI--PFVDDV-INLPDARAAVSAGCALYSLCLDKESSMLLVDCATHTLSTPSYTCQSIVVVPKGAPIPFSGMREIILSG   430
ReV-1     -------AASIDHHRKCGVIAVGGSSYLPGLMAVLSAV--PFVANV-IMLPDARAAVSAGCALYSLCLDKESSMLLVDCAAHSLSIPSYLCQSIVVVPKGAPIPFSGTRDITLMG   430
BYV       --------MRLEPNVKAKLLMVGGSSYLPGLLSRLSSI--PFVDEC-LVLPDARAAVAGGCALYSACLRNDSPMLLVDCAAHNLSISSKYCESIVCVPAGSPIPFTGVRTVNMTG   424
BYSV      -----------AQDAKASLVLVGGSSYLPGLKSLLQSV--DFVSEC-IDLPDPRAAVAAGCALYSSCLSSESPMLLVDCASHNLSIPNYVGESIVLVPAGAPVPFVGTRDINLAS   425
GLRaV-2   ------------AQIKCDLVLIGGSSYLPGLADVLKKH--RSVDRV-LRVSDPRAAVAVGCALYSSCLSGSGGLLLIDCAAHTVAIADRSCHQIVCAPAGAPIPFSGSMPLYLAR   424
AV-1      -------EGRPMNTTKASVILVGGSSSLPGLDKVLQGT--DFVSGL-VKLKNFRAAVAMGCALNSECLGSNPKNLLVDCAVKHISINAWNGEAITLVAAGSPIPFTGERRLIVNG   426
AcV-1     --------SGL--QGDITLVPIGGSALLPGIIASAKMYL-NKIGTE-LVYPRLRTAVSEGCSLVSATV-GIPGYLFVDCITSTISGVTGFFCVTPLIPRGSPLPCTATRSYRTSS   407
BVA       --------TGW--KAPVEVYLVGGSSSLPTVVDKIRQR--PYVSEV-FDLPEKRSAVSVGCSLYSR-MRLDNSVRLFDVLNTMIHDVTSGFMPTLVLPKYSPIPCVSTYTRDFAT   418
PeVB      --------SDM--KTDICLVPIGGSALLPGAVAEAQSEIRKWMGRT-LIYPRLRSAVSEGCAYFSSSI-LEGDYIFIDCCTSNICIPDTYIEPRVIIPVGAPLPIEVEVETHTSQ   409
ArPV-1    --------NN---LTTFSINMVGGSSLLNEIYNAVNRFGQSKGAKV-YRDDNLRLAVALGCACLFS-LESDPEFTYIDVNSQPLYDIGLYHIPEIVVRKPMPVPYTHVVSHDNSL   406
CoV-1     --------NE---ITNAVICMVGGSSLLTEVYNQVNNVAKGTNNKI-FRDENLRLSVSFGCSCLHF-FTDDPDFTYIDVNSHCVFEIDEMFKPSVLIRKPMPIPYTLRQEKQNNN   408
LCV       --------NK---VSSGALFLVGGSSLLKKIQEDVKAFAIRYKIEC-IVDKDLRSAVSFGCSMSHA-QEDTGNMTYIDCNSHPLMDVSFFCNPSILIRKPMAIPYTYKKEEKIKS   410
LIYV      --------NK---LTSGVIYMVGGSSLLQPVQDMVRSYASTKGLTL-VADQDMRSAVSYGCSVLHK-LEDNKEIVYIDCNSHPLSDISFNCDPEPIIRKPMSIPYTHTVKMRHDR   411
GLRaV-1   --------LK---RSPIVCVLTGGSVALPLVQQKLKTL--PYVSRTEYDSKTFRLSVAVGAKIYSDILTGHSDLRLIDTVSQTLSDELSGFTEIVIFPKGHPIPSEYETSFQISG   415
GLRaV-4   --------NN---VNSCAAVLIGGSSVLPGVRNSVASL--RGVSRVIFDKDTYRAAVAIGAAIYAQTFSGASRYRLIDCVSNSLSDERKPLRAVTVFPKGHPIPATVRVNFDMPK   409
                                *** *                         * :*: *.               .*     :                 .:*

FiVA      KVSDSELLIYLYEGRSTRVLYNELLASTKVLCSQLGNTSQTA-IDMVVHYETQISTTGRV--TCKVSGENGVGITIH---VQSVYDFEEGRLL-KLSTLNEQTQRDRLIDAISVI   528
FiVB      KKPSSLIHVCIYEGRYSRVLYNELLASSVIICSELGHTIDKA-VDIVLSYETMISTTGKV--VCKITGPSSQSVTLQ---VQSVFDFSSVILP-DMKVDDKEERLRGFVNNLFLL   525
FMMaV     LTRSAPIIFKFFEGESTRVVYNDPLFAFEFYLKDWGLDAWSI-SSLKVTIHTEVSSVGEV--SLRLSAANS-SLDMK---PSKLYDFPTPSKP-IPHIVNDNREKLDSIKNFIAL   522
RLMV      CSKTAHYNARLFEGDHNLCAYNDLIYSAEVPISSLGVQSATP-ISVNLVLTTKIDSVGKI--SFSIKGPSGVSIPVQ---GRAHYDFSTLPPL-KSVVVRLSSTDKDLASLVLAL   525
RLRaV     ATTTSTYNARLFEGNFMKCAYNELIYSKTIELRSLGVVAQQP-TSAKLKLLTKIDSVGKI--SFSILGPSGVPYYVQ---GKPHYDLSNLKGP-QRNLVRLNAKLRRETRLLLAA   527
SCFaV     ASINSYYDARLFEGNYTKAPRNELIYSSRVLLKDLGLNNRQL-TTVTVKLHTKIDSVGKI--TYDITGPSGVRKSVV---GLPHYDFSNISVGFGYKIKYLSDTNRNAAALILCV   525
CTV       CVSTSNYQARMFEGDYEKVFRNERIYAASISLFTLGVNWSVP-NDVEMTLVTKVDSMGKV--EFYLKGPSGELVNVQ---GTSHYDYAGMPHP-TRKLVRLSDYNVNSAALVLAL   526
BcLRaV-1  TGPTSTFTIAMFEGDSEHCRKCTRVFVSDVNLKKLGVTHNVA-R-FDVTVLTEVDSLGVI--KCYLKGGNGILVDTE---SKPHYDFKGCNRP-SRRVLSSEDADEDMVKFLLMT   524
CYLV      ASATSSYNAILFEGDYSKCPMNERIYSSAIQLKDLGITAVRP-VTRSITIELDVSSVGTI--TFKVKGEKGAEVTIG---KDRMFDFSGCHSP-TRSVMNLFKNVAERVVLNLVL   545
CNFV      AAATSTYKASLFEGDRIKCMQNELVYSSTITLSDIGVTSQVA-T-----------------------------------------------------------------------   475
MV-1      ATRSKKFYAALFEGEYQKCALNELVYSHNVPLSELGVTSDLP-RSLPMTLEVQISSVGTV--KFDIITDGDRRYTVG---KDRPYDFSSRNAP-SRNVVRMSDSLQRRTSSILYS   537
TV-1      VRPNNRFYAALFEGDHKKCGMNELTFSSYVPLHEIGVTDSTP-NRVSVILEVSISSVGTV--KFGIKLNQGELYTVG---KDRPYDFSKRGSP-TRNVVKLSESLGRRVTNILYA   538
ReV-1     VNARAKFYAALFEGDHKKCGKNELIFANSIILRDIGVNESSP-NRITVVLEVNVSSVGTI--KFGVKLPQGKLYVVG---KDRPYDFSRMPSP-SRDIVRLADELNRRVANILYS   538
BYV       SNASAVYSAALFEGDFVKCRLNKRIFFGDVVLGNVGVTGSAT-RTVPLTLEINVSSVGTI--SFSLVGPTGVKKLIG---GNAAYDFSSYQLG-ERVVADLHKHNSDKVKLIHAL   532
BYSV      CVGSGSYSPVLFEGDRTKCFYNKKVFSGTVPLKDLGVTGDTP-RTIRVTLATEVSSVGTV--KFTITGLSAKKVFVG---GVPAYDFSKESVS-IRSITELHTDNQNRVLLALTL   533
GLRaV-2   ANKNSQREIAVFEGEYVKCPKNRKICGANVKFFDIGVASTSY-EPVTFYMDFSISSVGAI--SFVVRGPEGKQVSLT---GTPAYNFSSVALG-SRSVRELHISLNNKVFLGLLL   532
AV-1      ASANASYTVTFFEGNYIKCAKNTVIHKFSIVLSQIGVVGNDS-RSVEIIIRVKVSSTGTI--TCSLVGPTGVELSTQ---GAPSYDFSGSAKP-VRVVADNHEDNFNRARTLLAL   534
AcV-1     -NYNVRYLIAFFEGDSIREFNNKLITRFRIDRKVLGINANAP---WSFSSKISVSPLGLL--TVEIVSGMSSLVINK---SAHVPVFDELSCN-LEKVVKPKNQLSSVALADYNI   512
BVA       -TGVVRTFITLFEGSGNRSFKNNVIYSKEVSSSTFGMST----GPMTLEIECNVTSLGVF--TLKARALQS---------KAPPLTFTSQSED--------------DLKMGIVA   503
PeVB      --KTSYFSSGVFEGGDNRLFYLNKIAAFTVKVVDFPLADAGVVESWSWILKLKLNALGMFSGTYRIAGYPQERELTV---APRVLTLQTIKQN-LRSDAYTFSELTIAVKDYLYG   518
ArPV-1    ---IYKTGICVLEGDAPWFLEADPLVNTSISTDIVSKAGE------GFEVHYIYAVDGTI--SIEVKSKDHKVVKQL---QNQLEQSFEFKEL-ELERVQYGNV-TEIVTMLDII   505
CoV-1     ---KFLTAVDIYEGDSQWFLDCQVLIKDVYSTDAVSSLGS------GYYRVIQYDLDGNI--NVWIENKDSTNKRNL---KSLITSHKTIKLE-NFERVQTGSS-SLYCTVAELI   507
LCV       ---HYSTILNVYEGSDPFILYNDWLISARMQSSLYCNVGD------TIEYLYKYNVDGIL--ELSVKNKTTGKETVL---PNTFTLTESIKKL-DLSLTQLSNV-DETATLIAIL   509
LIYV      ---PLKTIVNIYEGSNLFMPENDWLISSNINTTDFAKVGE------EYSKVYEYDIDGII--TLKIRNEVTGKMFTL---PNSFTKSDNIKPI-TFKLTQLSNT-DDLATLTSLL   510
GLRaV-1   ----STMEYGIIEGESNRTWLNEIAFKG----TDYRPSNERK----SDKVKYEISVDGKL--KLSVDGRQLKNTRLPAPVSASAHAYRYVSSM-KKYLIQLENN-----------   504
GLRaV-4   ----YNTGVVLHEGESSFINENARTYSAPLKTTQFP-------GGKTYVNEFVISEDGRL--EVKLNGEILANTVVPESPAANEYSERFLSSD-DKRIKPEVDD-----------   499
                    . **

FiVA      SYRKICKDVDSR---DRL-VIKELSE-------LGQSEL---VGKYG----LNDECLKSISMVLRSTFPGVLRRED--------------VSFVPFEV-------------   594
FiVB      SFGNYLNNSIAI---NSL-RLEDLSN-------LDLTSL---AKIYN----IDVEKLHPAEMVLRSDFPGVLWRNN--------------VSFLPFRS-------------   591
FMMaV     ASNPQARNNNKA-------LLSDTSVLSSTPSHVFIDTAA-----------AGPSEFDAAELVLRQTVPRNVRSST--------------VRRVPFGG-------------   588
RLMV      TQEIEARNDLHQ-------YLDKLNSAIVTPS-LSLEDHG-KAGTFPT---LTNGRVAKSRACMGKVIPKLLRGTN--------------VLVLPLQDHQ-----------   599
RLRaV     TINGVCRQSYPL-------FKTQLDEVLKSPSADDDLAL---LQAVPY---ITSECLNVADSRMGELVSGRLRGTD--------------VESIPF---------------   596
SCFaV     TLDPEARASYSFH--KED-YLCEINDA------KPLETY---RSKYDV---ASSYRISESRSRMGKAVQKILRGAA--------------VERLPL---------------   592
CTV       TLTREKREKFLLRTLFDT-LLADLRKT------ASLGEY---SKKYP----ITRNDIDVVSSRMGIVVSKVLRGSD--------------LERIPL---------------   594
BcLRaV-1  SRTDDDRNRCRKY--AQD-IVTTVATG------VSFVEA---SQKHSK--LIRDNDSEAVDLLLGRPFQGVLRGGR--------------VKRISIGGSS--------KL-   598
CYLV      TRTPEARSRLSLS--EVD-KLYNENRD------YQLQIL---KRDYPN---FNDVDTDVCRSLMGVFVQKILRGSR--------------VERLPL---------------   612
CNFV      ---------------------------------------------------------------------------------------------------------------   475
MV-1      SRSERVRSSIRED--VRQ-KIYSPESE------LAPNDV---VVQCG----LNDEEKSDCAKYLDSSVGKIVRGAS--------------ILKLDLD--------------   604
TV-1      TRHERIRENLSKQ--QLD-EIQERGSA------LTSQEV---ARKLG----LTTDEVNDCDEYLNNKIDKVVRGSS--------------ILRLELD--------------   605
ReV-1     TRYIHTRERISED--EMV-RFQSQSST------LTRVDI---IKRFA----VKPEEADECDEYLNGKIEKEVRGSS--------------VLKLELD--------------   605
BYV       TYQPFQRKKLTDG--DKALFLKRLT--------ADYRRE---ARKFSS---YDDAVLNSSELLLGRIIPKILRGSR--------------VEKLDV---------------   598
BYSV      TKTREARQKFSYS--EKQ-HLDSLSGN------LDTEKE---SKKFNG---YNEQTADVCRILLGKSVQKTLRGAR--------------VEELSYRNIYEVQT---LKI-   611
GLRaV-2   HRKADRRILFTKD--EAI-RYTESIDI------VDVLKE---YKSYAA---SALPPDEDVEPLLGKSVQKVLRGSR--------------LEEIPL---------------   599
AV-1      TRTLASRSKLTAA--EIP-RLSL----------PNILSV---KNSFSG---YNDSEYDVCGVLMGKPVPKLLRGGR--------------LQKLLIRG-------------   599
AcV-1     SQSIAKVPKIKAVDNITA-YLRYLRETQG----SDFPEVE--FKHYYG---SNEQITSKVGLEIRRPIPVFFREEG--------------YSVYPR---------------   584
BVA       TYTMQIRDSSAVKIGGRD-YANVISAA------PVFMTGG-KLSNFFTPNQLSGEYISMLLSARGEEISKSLRSKRGICADRDTAIDEEMKSRLPFPLTGYCDSVSVLKLR   606
PeVB      SSLVKNDEEFV---NVDS-YKDFLDTRGHIG-----------LLGFNAKSRLNDYAGADALLATRTPVPDFLRATG--------------YREIRR---------------   585
ArPV-1    KHHPSGQDFASIDLNFPNLALKYVNDHGG-------------ISRLDE----------------------ILRDIL-----------------------------------   546
CoV-1     KYHKLDKNIEAIDSNLFFKIKDYIEINGG-------------ISKYIE----------------------TLRKNG-----------------VQI---------------   551
LCV       SHFKPDLKHLLTYVKTPTIFETKLNNISS-------------TKELYS----------------------TLVGLNK-----------NFKNK------------------   556
LIYV      GYHDKNFERFYGLFNVPTILIKEIDKLGG-------------FKTLYR----------------------RLKSMNA-----------NF---------------------   554
GLRaV-1   -------------------YVDMFSELHGDK--ISIDDVYDATGAYFD----------------KNILVNFLRLSK-----------------------------------   543
GLRaV-4   ------------------------------------------IKSFYS-RILGDSNLKN----------RDLRGRK--------------EQYCKHGIV--CD--------   533
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Fig. S6. Alignment of heat shock 90-like protein (Hsp90h) (ORF6) sequences of FiVA, FiVB, and related viruses

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FiVA      MT-----------------NVLNPYRWYYGALFREYFGEKMYLSYLSK-SETLPTPVITG--VKFKYVNGARFLYLQQIENGQP--------GTFVREVRNLLAILHHLQLPKYC    87
FiVB      MS-----------------RNSIPQKWYYGAIFREYFGETMYRSYLSE-ADNLPYPIPYG--VTFFRGKP-EYWYVYELSNSKP--------RSFLREVRNLVAIVVKLDLASRC    86
FMMaV     MS---LSTQQL-----QDQASLTPQNWYYGKLFREMLGPRRYAECLLE-AESYAPFRVS---CNLVEAR--DYLRPHEVEPYQKYSA-----KGFINEWALLSEYLRIHNWPEIT    96
RLMV      MA------------------ESRSLVHAWGKLFRNFYGERTYSSYLSRTTNDFRSAKVRPKLPDHTRADG-SKVTSEQMWAAPQ--------GTMLNELAYLYCSDEIFGWSKRT    88
RLRaV     MS----------------------LTHEWGSLFRGVYGEPMWSQFLSDAAKTYNSSVFQ---EDHVTKDK-TKILAKTLRSAPM--------GSRDHEIALLHHSNNMTGWSEIC    81
SCFaV     MS--------------QVPIGSRNLGHEWGRLFKKFYGEPLWRDYLSRSAGSYRPELLK---EGYMSADG-KFITSEELAKAET--------GSVRHELAILIYSDSIYKWSDIC    89
CTV       MS----------------------SHHVWGSLFRKFYGEAIWKEYLSESTRNFDERNVS---LDHTLSSG-VVVRRQSLLNAPQ--------GTFENELALLYNSVVINDFVELT    81
BcLRaV-1  MT-------------------QRPLTYCWGDLFKVFYGVEESNEFLLEAAQNFNPSMVT---WGHKKEKG-GEVSNKQLLEATG--------NDILRELCLLHYSVAVYGVAKQC    84
CYLV      MS------------------TPTFAGHSWGCLFKRFYGVPVWKDYLSN-TASSNATYVL---NTYRFNSG-HSISASDVAKAGR--------SSAVYEFYLLLKSETIYKWCETC    84
MV-1      MV--------------------NFGRRYYGELFCRFYGSQHWEEYLNK-ASSLPLQRQS---EDYRFDNG-EVLSVNELNSTQP--------GSCEREFVILLTSEIIYKWCSVC    82
TV-1      MYAYALHNAEFIYSMANTSGRSSFVRSYFGELFCRFYGSENWKEYLAK-TSSLPIARQT---KDFTFKNG-YVLKASDINNSAS--------GSCEREFALLLTSENIYNWAKKC   102
ReV-1     MA--------------------NYSRSYFGELFCRFYGQEDWKDYLNK-ATTLPLVPQT---NNFKFKNG-FTLKAGDINNSAP--------GSFEREFALLLASENFYGWLSKS    82
BYV       MT----------------TRFSTPANYYWGELFRRFFGGQEWKNLMSE-AASVSRPRYS---SDFRFSDG-VILSRKTFGESTG--------ESFVREFSLLLTFPKTYEVCKLC    86
BYSV      MS-----------------RRPTFAGYSWGSLFKRHYGEPEWKSYLTE-TSMKYKPLKS---ESITFYDG-SSLTSAELRPARS--------GTAEYEIALLIFSDSITKWSEKL    85
GLRaV-2   MS-----------------------NHSWESLFKKFYGEADWKRYLSR-SIAAHSSEIKN-LPEIRLYGG-RVVKKSEFESAAP--------NSFEQELGLFILSEREVGWSKLC    81
AV-1      MT---------------------FVGYSWGNLFLSFFGEEDYKNYLSE-VSGYTGSQLP--VNAMEFRDG-STLSAAMMMNSSP--------GTPQREMYLLLTCERTNEWCSLM    82
AcV-1     MS-----------------RLLVRSDWKYGDLFRYFLGKKDIQSILAE-VQNYPSSCFKS--SHNIYRQG-DRIERIVLTHHPSYPRSIKYDTTVIAEYLMLCAYVEKHGIDKYL    94
          *                           :  :*    *       :                                .                  *   :          .

FiVA      GSTLSTFVMECDVYKGPV---SEENTEDAT----KTLCKFTLNDVSKLMPNG-------EIGYVRHMWALSNALGELVTDLDVGAYKHVLGGSRAL-----EVMIPTKTYGDYYS   183
FiVB      GSTIEHFVDQCDTHIGPT---SERNTEDPT----TTSCKFTLAKVASIFPNN------TDVGVVRHAWALSNALGTLTDGTDIRSHKHLLGGKTSV-----EVIMPIKTYSDYFL   183
FMMaV     GLSLYTIMYRIGLFVGPA---SDVMDLDPQ----QDCCKYTMSTVAAFLPPS------SSELRRYHSWALSNSIGSLTDSTKLAEFK---LNSENFEETV-EVELPEPTMSDYLY   194
RLMV      GVDIKTLLRGIESRTAAP---PEMIPADAA----KEGCRFSLQDVESFLLSGNFH---VDTLTVEHSWALSNACGRLVNPNDVKEFKGMVYDPTLNTAK---LTALSSEMGDYLG   190
RLRaV     GIPKAMFLQGSEEVRSDV---TLFMDVDPT----KVGCRFSMDTVKNFIVDTCGEK-DIAKVRVEHSWALSNACGKLTDADDLHEYKAMVFGEKSKDSV---IDAVDCPFGDYLS   185
SCFaV     GSTPRSIFEGVAGMSLPN---GEFLEVDTM----RTGCKFDIDVVKGFLNYDEMEKDSEKELHAEHTWALSNATGTLMDASHVEKFKTILFKDNTNLDI---TDNIHNVYGDYLS   194
CTV       GMPLKSLMTGIEDRKVP----DELISVDPH----EVGCRFTLNDVESYLMSRGED--FADLAAVEHSWCLSNSCGRLLSSTEIDAYKTLVFTKNFDSN----VSGVTTKLETYLS   182
BcLRaV-1  GVRVNSALKGIECYTAEDLAPSEAVTAKTK---FESGCKFSLNAVGQHVINRPAG---TGKAYVQHFWALSNSAGVLIGPSEILKYKAIVFKDTLGVTP---DVNIELKLKSYLA   190
CYLV      GIGIQTAFSDYDTNVNSFRS-NMLIDVDVK----TVGCRFSLSDLEAALRPSHPLE-IRDKTFLEHCWVLSNSCGEIIDPLDIKRFKSITFGDANALGKADETLMIGSSVGDYLS   193
MV-1      GLDVKMGMSTVNTGRDLNFSKDPFISVDVK----STGCKFPMNDIKTFLGTKG-----DDIELAEHCWSLSNSCGEMIDPSDISRFKAITFRSDSESKS---EAVTSSRVIDYLS   185
TV-1      GLEPSSAFSTVNTGVDLDKCEEPNISVDVK----STGCRFPISEISSKFVNN------ADQDLIEHSWSLSNSCGEFIDPNNVDRFKSITFEDHDISTD---SVSIQSKVVDYLS   204
ReV-1     GLDPRSGFSTVNTGEDLDKCEDPFIDVDAK----SVGCRFPISEITSRLGAN------TDQDLIEHCWSLSNSCGEFINPNDVNRFKEITFDRHSELDK---LESVHSKVVDYLS   184
BYV       GVAMELALNGMNRLSDYNV--SEFNIVDVK----TVGCKFNIQSVTEFVKKINGN--VAEPSLVEHCWSLSNSCGELINPKDTKRFVSLIFKGKDLAEST-DEAIVSSSYLDYLS   192
BYSV      ERSIYRGLNQINNHSIYAE--TELEVTDVK----TIGCKFTISAVESFMGGR------ASAAQVEHCWSLSNSCGELINPNDTARFIQLVFKDKAVTEQA--QVNTSGSVSDYLV   186
GLRaV-2   GITVEEAAYDLTNPKAYKFT-AEICSPDVK----SEGQKYTMEDVMNFMRLSNLD--VNDKTLAEQCWSLSNSCGELINPDDKGRFVALTFKDRDIIDDA-GAANVECRVGDYLV   188
AV-1      SLNKYKATAGVNIFSR-----PLVYITDAP----TVGSKFSKSDVVTFLRRLGKD---PAAANVEHCWFLSNSCGELIDANDTSKYSKIVNSGITLALD--EEVKLTSKSGEYLA   183
AcV-1     DTEVFDMLSDIMYDFDLSD--LDLTIVQLPRKRLEANLQFKLSDFDMPEYSRYT----RDQKLIFK--TISNAMSMKYNP--------LVLVSGDLIYADVKSDNSEILINNYEL   193
                                     .          ::    .                    :   :**: .                                     *

FiVA      ECIDTYDMSFVNNPQ-RHSLRKELIATCVRFLSETY------EVVEDWFLKNIIIM--GAIQKCCEEKNLFSSGYIATVNAVR-VLYSHLVTCVFTPWEWS-KVKDIDVRTFVPI   287
FiVB      ECYESYLTYCEVYPE-QYNLRKDLVELYFDRCATKY------NVEKNWFLNNPILV--GGVIKYTVENNLYFSNYRGTLKALN-SICGFFDPVLNNGVNLI-PKKEVDIRLIVPF   287
FMMaV     NCLVLCETECVISPS-RFLIRKTLFDICVEYFLDS-------DLGMSSETSYPILT--GVILEIMSSQDMFPSSYVTNVKNAS-YLVREFRLILDAIMQVHYPTPEPDLRVLVPI   298
RLMV      HCMELYKRYVITKSD-EVTVRKEVFIWIETILAPY-------NLSYYGVDSNPLLT--GIIFDFMFEHSVYPSNYGVNLKNLR-IFKDSFLPVILDIWEYEPSEKLADERLIIPA   294
RLRaV     HCLGLYKKCTVATDS-EMRVRAEFFKYMAEIVNAY-------DLNYNEPSDNPVLT--GIMLDFVLSRKIFPSSYAVNLANLR-KFIYDFLPMILKVWVVTPRDVHFDERLIPPC   289
SCFaV     YLIELYKRHVIISHD-ELNLRRDFISYVIDYLNAY-------DFGYADYSDNPLIT--GFLLDFMIHNRVYTSTYSVNLSNLR-LFISKVLPVMLDTWVIATPKIIKDERLCIPI   298
CTV       YCISLYKKHCMKDDD-YFNLILPMFNCLMKVLASL-------GLFYEKHADNPLLT--GMLIEFCLENKVYYSTFKVNLDNVR-LFKSKVLPVVLTVWDISEPDDPMDERVLIPF   286
BcLRaV-1  FCVASYRSDFLSKSVDERVVVEPVLRWLRDYYSTT-------SLSTDAF-ENPLLT--GLFLEFVSKYTVFDTTFRKNAANVQ-RFINEYAPLVAEIWEYEGSPKSQDSRIIVGL   294
CYLV      HCLTVLARSKLPSSAGETKMKDDWLAHCITYFSAT-------DLNYSSKEKIPLLT--GIIYELIDQHKMFLSSYANNVKNFS-VLLGKIVPTIESIWTFKWLKKPTDHRLLFEF   298
MV-1      HCLSIVDMVSLPSQKGEKRMLDKVFEKYLTYLGSS-------TLVTNGCCDNPLMK--GVVFDFVRENAAYLSTYANNIKNFS-IFSATYMPVIEDTWHFKWNETPPDFRLLFDF   290
TV-1      YCLMLVDMSLLPSLKGEKNMMDKMLEKCLQYYATS-------TLITSVGEHNALLK--GVIYDFIKEKSAYISSYSNNIKSFI-NFQASYAPVIEEVWKFRWLNSPPDFRLLFEF   309
ReV-1     HCLMLVDMSRLPSFRGETNMMDKMLSKCLAYYEPS-------NLTIPTGNCNDLLR--GVVYDFIKEKSAYVSSYSNNIKNFI-TFLASYAPVIEEIWFFQWVGDPPDYRLLFDF   289
BYV       HCLNLYETCNLSSNSGKKSLYDEFLKHVIDYLENS-------DLEYRSPSDNPLVA--GILYDMCFEYNTLKSTYLKNIESFD-CFLSLYLPLLSEVFSMNWERPAPDVRLLFEL   297
BYSV      YCLQLYDNSKKKSNAGRTQLMESYVSFIRDFFQHS-------DLYYRSPLDNPLLT--GVLYDLCIEHNVLRGSYLKNLDNFR-LFKQTYLPMIDDIFDYSWELYAPDERLLFPI   291
GLRaV-2   YAMSLFEQRTQKSQSGNISLYEKYCEYIRTYLGST-------DLFFTAPDRNPLLT--GILYDFCKEYNVFYSSYKNNVDNFR-FFLANYMPLISDIFVFQWVKPAPDVRLLFEL   293
AV-1      YAISLYDSLQTESQSGRKKLYDRYLSYVIKYMAPS-------NLSYHTPEVNPLLT--GLLYDMCDHDNVYVSEYVTNLNSFRSSFLEKYLPSVNDFWEYDFLQPAPDERLIFPL   289
AcV-1     LCRMYKYGEAIASGALNSRFSVNGTHWLNRFMNNLMIASKGVGAFYIGDWVAPTLCYLGLISKMCDHYDPF-GKICDNDSQLA-IINEPPVLTCMSLIFAPLNSFVNDVKMLLPF   306
                             .                                  :   * . .              .       :                     * :

FiVA      EAQEFVVE-SNCMSLVDNTVILNSVIWKVSEVVQEDALNEIGKVIETLLKVSN--PDVSVATLWGCFALYYSIHRTAKQRVERRPNGIRVPWTL--KDTSEVDVVEMSGVEEFFD   397
FiVB      TNVEFVVE-SNTLSLSDNTVILSSVMWKVENVIQSDALEGLAQLIEAKLTSSN--PKVDVSTLWACFAVYYSVYRTAKNRVEPRPSIFSIPEVF--KGDSKDLTISMREVEDLFT   397
FMMaV     TPVEFMFD-LPVYSLYDGVVIMAHGIRRLDRVISDSTFAELFYVIQSVMIKNN--SGVDEQMLWVAFVLYYAVYRTAKERVQPRPPSFEARMSN----GSPSTLVNFVEVERLFS   406
RLMV      SAMDFALH-IPKLNIYDMSVVIGERLKFLEVVFEGEKLESITQRVIALLKVSN--PDLDEDVLLDTLFVYYGIFCTARSRVVPRPSSINTIR-------GDLKPVDVSQIESFFS   399
RLRaV     ELVDLAMD-VPKFNFHDLNTVIKGKLRSLEIECEDPDMNVISEIVFSKLEADN--RNVDKHLLREALFLYYGKYCTAKTRVVPRPSRFRV----------SGVEVSFTAVESWFS   391
SCFaV     SAVELVSS-LPSLNLYDRTVLVGDKLMSLEYRFEYEAIESMVDKVKATLLESNKLSGVSELHLFDTFYVYYAVFCTAKERTIRRPAQYMLY---------KGESVSMEEVEDLFD   403
CTV       DPTDFVLD-LPKLNIHDTMVVVGNQIRQLEYVVESDALDDLSQHVDLRLAADN--PDLRVGLRWAGMFVYYGVYRCVVDRAVERPTLFRLPQKLLSQDDGESCSLHMGSVEALFN   398
BcLRaV-1  HPDDFCRN-LSTLSLDDMEVTLGGIVHSLEIVIGEKLMDDIDEMIDALLLQSN--PNVVYSHRWVGFFVYYGLHRTNRDRIDKRPDYIDVVISK-----NTTVRVRMVEVESFFN   401
CYLV      SLSDLNKSASQVLSLNDMTVVLESKLNLLERVIHHSNIDSLKEVVDAILKDEN--PDIDGETLWICFHCYYGQHRTAAERVQARPEYYEPPFSL--KKADSKLKISFVGVEKLFT   409
MV-1      TLTDLTDKSLPLLNVNDMQVVLGSQVKYVENVLMDVDILSMRDYIYALMKKSN--SWADESTLWAAFHCYYGTYRTAISRVVSRPLLYVPPPQL------TTRVIDFSTVENLFD   397
TV-1      TLADLTDERLPLLNINDMQVVIGSQTKYLENVLMDSDVVAMREYISSLLVKAN--PSSDLGMLWMALHCYYGTYRTAVTRKVPRPLLYKPPYQL------TTETVNFTLVESFFD   416
ReV-1     TLTDLTDDRLPLLNLNDMQVVIGSQTKYLENVLIDADIKLMREYVSSLLVKAN--PTLNLGLLWCAFHCYYGTYRTAVKRKVARPLIYKPPFQL------TTEPVDFSLVESFFD   396
BYV       DAAELLLK-VPTINMHDSTFLYKNKLRYLESYFEDDSNELIKVKVDSLLTRDN--PELKLAQRWVGFHCYYGVFRTAQTRKVKRDAEYKLPPAL------GEFVINMSGVEEFFE   403
BYSV      DPYEIIKE-VPTMSVIDANVVLSNKLVYLDSYLENNSILALEKKIISILCRDN--EGIDEGALWAAFFCYYGTYRTARQRVVKRPDTYELDGIF-------SKPIVMSGVELFFD   396
GLRaV-2   NAAELTLE-VPTLSLIDSQVVVGHILRYVESYTSDPAIDALEDKLEAILKTSN--PHLSTAQLWVGFFCYYGEFRTAQSRVVQRPGVYKTPDSV------GGFEINMKDVEKFFD   399
AV-1      DDFDLVSK-IPSLNINDSTVLLGGRLKYVESIFTHQFGDDLDGVIDAVLQQSN--PSIKRETLWVALFTYYGVYRTAKTRIVPRPEVFTFPPGY---PSELTCEVNFSTVEKYFS   398
AcV-1     YLTADGTL-SRTLNYSDLSFLPVQRSRL--NLLSKDFVRRITANILYLPDYDDSLHELGTYWLFSAVCIYYGIEGTNRFRKTTRGKGVCFSD-----HSGKTYLVDMTRLEMYFD   413
                       .  *                       :   :       :             .  **.       *   *                    : .  :*  *

FiVA      NIQKVNPNINVRKQFLGSIGSSVLNLLKSLNIKL---------PQISTYKLPEGYEYLYVDFYKQIRRKGLSTDEIKHLTKLRGAVNVMLEERISLRTLNIGQIPTL--------   495
FiVB      HIQLKNPTINVRRQFVGSLGASIISILKYLDIRL---------PQISKLTLPADYSYLYVDFYKHIPRKGISTQECKYLTMLRDSVDVMLTERISLASTRKNNRRDS-LIEKRVA   502
FMMaV     DLQVKNPTINVRRQFNGKLGPLALNILRSVRPTL---------TNIAGIILPAKYGYLAIDYYKHVPKSALNEEEASILAQLDRIVDLILGSKLSTISLDKKNSRRKRNPKSRIN   512
RLMV      ELQLSTPDVNVRRSFMGHHYKRVLKLYKEIGLKL---------PPKCDYIVPAEYGYLNVDFYKQIGSDVLTEEEMGHLTAIRDRVDYKCRNIVSLNSTPAHGSKFS---NSRRI   502
RLRaV     RVQFAELNINFRRDFMSHHATEALQVYKKFGVKY---------PPKSDYIVPLNMAYLNFDFYKGVKDSGVNEEEHYHLKKICAAVDAKCRGLYSLQKVSENDVRRR---VGKRG   494
SCFaV     SLQKASYDVNVRRCVLGAMGDRGFECYKRLGLRF---------PPKSDYVVPDHMAYLNVDFYKQLDESVLTPEESHHLSNIRRRVDVKCNNLVSLKKTVFKDSSSS---FSNVV   506
CTV       LVQKVNKDINVRRQFMGRHSEVALRLYRNLGLRF---------PPISSVRLPAHHGYLYVDFYKRVPDGAVTADELESLRQLRSSVDVMCKDRVSITPPPFNRLRRG---SSRTF   501
BcLRaV-1  ECQRWNPGINVRRSFNGRKSCVAFEIFKRLNLKF---------SPLVEVKVPVNMEYLNVDYYKQVVYEGLNNDEIAYLNIVRKKVDLKLGAKLSLKSKEPVDKRMR---STFLE   504
CYLV      TLQGQNPGINVRRQFCGRISHEAIFVFKKMGLRF---------PTIATVIIPPELAYLNLDYYKWVDTSQLNPKKR---------------------------------------   476
MV-1      TLQKRKPDTNIRRQFCGKLGVEAIACFKALKLSF---------PKICTLNVPLEYGYLNIDYYKHIPGRNLSDEERLILCNIKDSVNEMCLNRALSTE---KRNAQR---HPKLL   497
TV-1      KLQKGRPGTNVRRQFFGKLGTEAIAVFKKLRVGF---------PKISAMNVPDEYSYLNLDYYKHIPEKGLSEEEKLVLCNLRSSVDEMCTNRALSIS--VRRDAQR---ESRGN   517
ReV-1     KVQTGRMNVNVRRQFCGKLGAEAIMCFKRLRVGF---------PKISALNVPGEYSYLNIDYYKHIPDKGISDEEKLILCNLRDSVNEMCVNRALNVN---RSSALR---KPGSI   496
BYV       ELQKKMPSISVRRRFCGSLSHEAFSVFKRFGVGF---------PPITRLNVPVKYSYLNVDYYRHVKRVGLTQDELTILSNIEFDVAEMCCEREVALQ---ARRAQR---GEKPF   503
BYSV      ELQKRVPDVSLRRRFNGAKAGEAITVFKKLGISF---------PPITRLNAPSKYSYLNIDYFKQANSLGLTEPEKIILCNIAKDVDMMCAQRISSVK--AKPIAQR---NGEAI   497
GLRaV-2   KLQRELPNVSLRRQFNGARAHEAFKIFKNGNISF---------KPISRLNVPREFWYLNVDYFRHANRSGLTEEETLILNNISVDVRKLCAERACSTLPSAKRFSKN---HKSNI   502
AV-1      DLQTKAGNSNVRRNFMGAHASEAFRTYKALGIGF---------PPVSALNIPEKYGYLNVDYYKQAKVDHLTDEEATILKEVSRDVDAKCTRRLVNSNPVNKSI------NKDAI   498
AcV-1     ELQKDITSYSVRRAYFGTIIEFVNKIYDTFRCQFLCRWYYNGYGPMSSKD--------YTDFFKY----NSSGADVKYLKSMRAYSGV-----VSLRPNYRGAIRQK-------V   504
            *      ..*:   .                                           *:::       .  .

FiVA      -------KIFDTKKER-----------------KRI----------------------------------   507
FiVB      NVQ----KVIDPRREKVC------------RRTKNL--------------------------------PR   524
FMMaV     NYRSRELSAFDDSRFK--------------SATDKLFLKDARSLGSWPQGQTLNQLRTLQLH--------   560
RLMV      NRR---------------------------SFTRKV----------------------------------   511
RLRaV     RRR----RGELRTPNA------------------------------------------------------   506
SCFaV     KYP----NSARTKKVAYS------------RIPRSVRNNGSI----------------------------   532
CTV       RGRG--ARGASSRHMSRD----VATSGFNLPYHGRLYSTS------------------------------   535
BcLRaV-1  RER----KRSDNQHLRVS------------KISKSLISLGDL----------------------------   530
CYLV      -------------------------------------------------------------------GPC   479
MV-1      PNK----NSFRDRDSEHKRTLSVSKNGLD-ALRRRLYCSTGG-----------TERRL------------   539
TV-1      SLA-------KRSAERTSGSKFTKSHGLN-RLKQRLFI--------------------------------   547
ReV-1     SLV-------KQTDKRTSLANTRKIDGLD-RLKRQLHI--------------------------------   526
BYV       QGW----KGTKNEISPHARSSIRVKKNND-SLLNILWKDVGA----------RSQRRLNPLHRKH-----   553
BYSV      NSA---------------KIRTLPTNTLVRALEKCLLNQA----PSWWNTTLTNLR--------------   534
GLRaV-2   QSS---------------RQERRIKDPLV-ALKDTLYEFQHKR-AGWGS---RSTRDLGSRADHAKRGGG   552
AV-1      RTA----KRLPTGIISRRVLP---------SPTSKLLSDLRKN-TEWATTLRRNTDRATSQYPHHPTRLR   554
AcV-1     RRR-------------------------------------------------------------------   507
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Fig. S7. Alignment of minor coat protein (CPm) (ORF7) sequences of FiVA, FiVB, and related viruses

```
FiVA      MA---DSSTEGTDKTVATKTSSNALSD------------YSSGYVNSIFNEQFSTNIQKLDLNSISQTRPDRCQSEELELILGDLKEFLVAQYSIVPADFILHLSMIIVRLNSTT   100
FiVB      MS------SDEKSTALVTQNLTKALSE------------VVVEKVGTVFSEQLLGSLSKINLDSISQTRSDIYEKEELRLILLDLRDFLVTKYAIVSEDFILHLSMIIVRLSTTS    97
FMMaV     MASGTDAQSTSNSSTSLVSAPSNAL--------------SSKLVPIENTLQSLNSVLDRLDISSISQTRPDKYTEEEMRHYLDEIKNHMITVYKIDEKDYMIHLTMIIVRLAVVS   101
RLMV      MT------------LVPVKVNDSPVSPADA---------AAIITSSRQDPTSFGGILARLNVASISETQTDRFSDKQLLEVITKLSSFLKETYHTLDKDLIIHITAIVKRAFTLS    94
RLRaV     MS--------------------SALGD----------SKTLIPFVATPSDESAKTLAGAFDINSVEENLDERYTQAEVTEVLHRLETFLVTTYKIDTKHFAHHLAAIIKRAATLT    85
SCFaV     MA--------------LVNSEVSAL---------------QSNELSTNNNAIPNSLDSVLVLSSISESSIDHYTSEEIPKVLNDLQTFLITKYSIRPEHILSHAAMIVKRAATIS    86
CTV       MA----------GYTVLPKTDDKEMDPVSAAVPGKYPDVIEKFVANRSVDALIEGVISKLDTNSIYEDSTEKFTGEHLKYVMVTMDTFLLENYKTKTEDLLVHLTMIQKRLYTIS   105
BcLRaV-1  MA-----------------NDGEKLKGFNA-----------------------ANILNGLDVDSIEQYSTEVFNTSENTEINNKVFAKIKELNHANDADKAAHILAVLTRLATRS    75
CYLV      MS-----------KELMIVSPDGSLEK------------ADVSKLAIATRESMQAAFSALDLSSVSGTSDSCLSDSELTEAATKVNTELKKITKGEDIDMPSHFAALIARAATIG    92
MV-1      MA--------------LTLSDADYI--------------AQPAALRDASSEIVEKFSEGLDVNSITHSTDSAFSKKEAEEAIPGVLSRLRELTKADSKQDIVHFMMLMCRAQIIS    87
TV-1      MA--------------LTASNNDFS--------------SKILEARDISSEVVEKFSENLNVDTITQSSDSSFSSTEVAEAFPAVLAKLREITKSDPKQDAVHFMMLMFRASNIS    87
ReV-1     MA--------------LTVSNDNST--------------SSLLNEKDLTSEIVEKFAAGLDLNTISQSSDSSFSRTELDEALPSVLGKIREITKADSKQDAAHFMMLMFRAAVVT    87
BYV       -----------------------MLAP-EA--------RGDLIHFTENTRDAMETFFNSYDLAEYSEVNPNKLNRKETDELLGVIRERFKSELVITDEDFVKHLAFALIRAANIT    83
BYSV      MP---------------PQPGAELVEH-NA-------NKSSLEVFSSETREKVGKFFNNFDHKTFKQVNPNLLNEDELREVLGKLKTELKTNLKALDEDIYHHVAFFLLRASVVS    92
GLRaV-2   MS----------SNTSVPVGGLEALET-SG-------------VVLTTRKEAVDKFFNELKNENYSSVDSSRLSDSEVKEVLEKSKESFKSELASTDEHFVYHVIFFLIRCAIIS    91
AV-1      MGD--DVTKKYGSGDISVSAPPDA---------------SPLGKELGLSLRAVEAFFQSFQSTEYKASSSETYSQPELERLVGGLKAAFKATVKANEDDIGLHICFILLRAGQIQ    98
                                                                                .     .           :         .   *      *

FiVA      CSEKYTFGQTENISYIVSG-----VRYRIYDHQLFPFLRALCKKHLPSVKNGVRKFASSCEALLVTLGHLRPDLFESARATRAGTPHGKGWLASDFISGVYPDISENERAVAIRA   210
FiVB      CSDKYTFGKSERISYTISD-----IKYTLYDCDLFPCLRALCKKHSPSTKNGVRKLASSCEALLVTLGHLRPHLFDSARSTRAGVPLGKGWLASDFISGIYPDITENERAISLRA   207
FMMaV     TSDKRSYSPHDHIKYVVGG-----TSYKLYDNAIIPYLKNLMHDP--DVRNPLRKFCSTAESLLVSIAAIRPDLFETHRATRSGTPMHKGWLSADFVTGSSPLYSELDRSMLLRS   209
RLMV      TSTKVKYSNTGCITYSLNDN----TEYTLYDKDVFPFITNTFGGV--DTPNAIRKFCCSFELCHTALANLKPSLYEGKRFTRLGTPKGKAYLGADFLTGTLPSYSEHDRAITLRC   203
RLRaV     TSTKVVYRDRVGISYKVEG-----VRYELNDMKVFGFIRAAFTTA--TNPNPLRKLCCTFQDLLLWMASERPEMFDSRRTTKLGAPKGKSYLATDFLSGNSKYNSERDRAIIIRC   193
SCFaV     TSMEARLVPGSHISYDLKTSDGTVLHYKLEDTVVFGYIRTWKDEV--SNPNPVRKLRCTLEILHEWLAHKRPEIYETKRTTKLGLPKGKAYLGADFLSGNVSTLSEHDRAILLRS   199
CTV       TSTKTKFRDKGCISYVQGG-----LRYKLLDKVVFPFIISKFTDR--ETPNALRKFACTFEELHLCMARLRPDLYENKRTTRAGTPHLKGYLSADFLSGSLPGYSEHERGIILRA   213
BcLRaV-1  TSRKVRDDGKGYIRYPING-----VKYEIKDSDIFPYMLQLPLIA--SVPNGLRKWGATNEAGVVFVAMKKPKLFESRRSTRAGTPMSKGYLSTDFLTGSLPEYSELDRATMRRS   183
CYLV      TSLSAVYR--NQQTYSIRGK----GKYTVKDAEIFPYIIDITAKY--GKPNGLRAFFASLENAFLVIAKMKPQLFESRVATRRGTPKEKGYLATDFLSGASPILVDQERAILNSA   199
MV-1      TSMKVKYT--GSYSYTVGG-----MGFTIKDADIFPHIIHMLAKY--KKPNPLRALFTTFETPFIHFSKIRPDLAETRSACRRGTPTGYGYLSADFLTGSSPSLNDRERAIVNRS   193
TV-1      TSTLVKYT--GSYSYTVSG-----TSHEIKDADIFPQINHLLAKY--KKPNPLRAFLSSFETPYILFSKLHPNLNESRIACRRGTPQGYGYLAADFLLGTSPILSDRERAIINKA   193
ReV-1     TSPKVRYT--GSYSYSVSG-----VSYQIKDADVFPHISHLLAKF--RKPNPLRAFFSCFETPYVYFCKLNPEMAENRTACRRGTPHGYGYLAADFLPGSSSALNDRERAIINKA   193
BYV       TSVKVNYV--GAYEYTIGG-----KKFLVKDAWVFPLIKECMKKF--NKPNPVRTFCATFEDAYIVIARSLPKLFLNRTIGKRGIPSGYEFLGADFLTATSVCLNDHEKAIVLQA   189
BYSV      TSPKVEYK--GSYSYSIDQ-----RKYTVNDAWIFPQVKILASKH--NKPNGLRAFCASLEGMYLSVARLGPDAFGTRSVGKRGAPSGSEYLGADFLTSTCPLMSDHDRAVALSA   198
GLRaV-2   TSEKVKYV--GSHKYVVDG-----KTYTVLDAWVFNMMKSLTKKY--KRVNSLRAFCCACEDLYLTVAPMMSERFKTKAIGMKGLPVGKEYLGADFLSGTSKLMSDHDRAISIVA   197
AV-1      TSLKYKND--TSYSYRLSN-----TEYTVSDLWVRSTIARLGDSI-KKKPNPFKCFCASFEDLYIAMAKTHPELFKNRTIGRRGTPSGYEYLSADFLSGCSPLLEDRERAVAIRA   205
           *            *           . : *  :   :            * .:      :     .    .          * *    :*.:**: .      : ::.    .

FiVA      RDVNLSRVSMEKD--HLVSLYDIT-----   232
FiVB      RDVTLSRGSADKG--VLINLYDLVQ----   230
FMMaV     REVNLSRTSRDRSG-VLVSLLDLGN----   233
RLMV      SETALTKTPGEDF--AIVSLRDLGRRSLV   230
RLRaV     AEVALTAPQSVEHG-ELVSLRDIGRYI--   219
SCFaV     SEVALNRPSKSPKV-SLTSLYDMVKEF--   225
CTV       SESMLARRQGYEEATELLNLRDLGKYL--   240
BcLRaV-1  QEVNLDRVTTDLSG-SLISLSDLGNQRCR   211
CYLV      SSYALDRAASKKKNSGLVSLYDYGRYD--   226
MV-1      SEHAINRANLTGASKELVSLYDIGA----   218
TV-1      TEHAINRANTSSVSRELVNLYDL------   216
ReV-1     SEHAINRSNMSSLSREIVSLYDI------   216
BYV       SRAAIDRAVSSSVDGKIVSLFDLGRLS--   216
BYSV      SRNALDRSAASQIDKKMVSLYDFGKVVYT   227
GLRaV-2   AKNAVDRSAFTGGERKIVSLYDLGRY---   223
AV-1      SENALARHNGSNSEKLLISLYDL------   228
              :           : .* *
```

Fig. S8. Alignment of coat protein (CP) (ORF8) sequences of FiVA, FiVB, and related viruses

```
FiVA      ----MAT------TPSKDAQDLQQITATTP------PPSAPPQSTPPPQNSLIAGAGSTIVNTTELSHLFVSDIRKLDE-KKLEMANNHFRSCLTNVFGPIPDKEAAFKAALPAI    98
FiVB      ----MADKVDNQSGYVPLASE--KSSLTTPLLPKKDNNSSQSSYAPPKDQVDIPGAAAISSQPVGVSSVFVSDVRKLNS-VNLARANEYFKRSLEGKFGSIQDKSEAFEVALPAI   108
FMMaV     ----MASGTDAQSTSNSSTS------LVSA------PSNALSSKLVPIENTL--QSLNSVLDRLDISSISQTRPDKYTE-EEMRHYLDEIKNHMITV-YKIDEKD--YMIHLTMI    93
RLMV      ----MAE-----------------------------------------------------FTIADLKEINVADNTTLSE-EVEAKITKPLLAKIETANPGFDDKG--AKLLVGMI    55
RLRaV     ----MAL----------------------------------------------------VDDFTDLGTIVVADSTAMSF-EGSKKVAEELVFELKKTNNLFDVDK--LKTHWAMV    56
SCFaV     ----MPE-----------------------------------------------------VRYSDITGLSVGNSTATNT-ADAALVAKDILAKVKETNPTLTDDH--LNLIWGVV    55
CTV       ----MDDETKKLKNKNKETK----------------EGDDVVAAES---------SFSSVNLHIDPTLITMNDVRQLST-QQNAALNRDLFLTLKGKHPNLPDKD--KDFRIAMM    83
BcLRaV-1  ----MELSRQFVYIIRTADYDFIEITRRSYLWTLTFERSKMSTGKP-------------SLTLSDIGNVSVKLDKELNE-KELAIVSAGLVKILTEE-YKFKADD--VLLHMYMI    94
CYLV      ----MPE-----------------------------NDSNDSSNKS-----------ALTQTPSKLSSVSISDKRLLTG-AVKDAAKIKFFTGITAKYPSINIAD--TNTHLGML    68
MV-1      ----MVD---------------------------------------------------TAGKLAVIDAFNVEDERIISSVSDLAEIRQKFEKFVTDK-LQGDLKD--LDLHLGLI    57
TV-1      MLTTMPADEK-----------------------------------------------S-NSEVPILDSFKVDDERIISSIEDIVEIKGKISKFIVDT-LKGSADQ--LDLHIGLM    64
ReV-1     ----MPAEDK-----------------------------------------------NVESEVLVLDSYKVDDERIVSSTEDIVAIKGKFSDFITNV-LKGSGEQ--IDLHLGMI    61
BYV       ----MGS-------------------------------------------------AEPISAIATFENVSLADQTCLHG-EDCDKLRKNFEECLKLK--GVPEDN--LGIALGLC    57
BYSV      ----MAGGND--------------------------EGSDDSSASQ--------TMTAKDMIFAPFENFARASATCLNG-ENKKKLFEEFSVRVKTQ--DVTESG--IPTTLGMT    72
GLRaV-2   ----MEL-----------------------------------------------------MSDDNLGNLVITDASSLNG-VDKKLLSAEIIKMLVQK--GAPNDG--IEVVFGLL    53
AV-1      ----MGDAAKLLAAKNA-------------------AGGTDGTTDD-----------AGQTLGGRLLGLTFGSPVLKTG-NDKVKLLKTLGEFMVSK--GAKPGE--VSDAIGLL    76
              *                                                                                    :   :

FiVA      LYFFRIHTTSGEAKH--EQTSVNFVL-GNVRVTISESDLIEAAKTCPQL-RMYSNSIRAWCRSNEKTYIDYSRQNPD-LPSSARATRIGLPAHYSWLEADFLTG-EHL-TDEERA   206
FiVB      LYFCRIHTTSGEAKH--EQTSVNFLI-GNQNVNIVERDLVETARNCPQL-RTYSNPLRAWCRSNEKRYIEYSRQNPD-LPCSSRATKIGLPSHFSWLEADFLTG-EYL-TDEERA   216
FMMaV     IVRLAVVSTSDKRSY-SPHDHIKYVV-GGTSYKLYDNAIIPYLKNLMHD-PDVRNPLRKFCSTAESLLVSIAAIRPD-LFETHRATRSGTPMHKGWLSADFVTGSSPLYSELDRS   204
RLMV      LYRLALRTTSPNATF-NAHDVTTYKV-DGKSVKFDDEMVFGYIANHEAIPPGIKNPLRAWGRALDQKYLKFIRPLKTTLDFNQRCNKIGLPVGYEYLCADFLTG-AGL-DNQEAA   166
RLRaV     LYRMALLTTSPLAKL--SNEITSYKI-GDKEFSFSDDQVFNFLKNHPKS-SKYPNFLRSWGLGSETVYLDFMRRKKDTLHFTSRATRIALPEGYEFLCADFLTA-NNLKDNKERE   166
SCFaV     LLRLAVRTTSEKSLG---FEETTFKI-GDVEYKIKDEDFVNVVDKHVKT-RFEKNPLRHWARGSNAAYLDIARKTPNEI-MSARALKCGLPKDVGYLCADFLVG-SGL-SDFERT   162
CTV       LYRLAVKSSSLQSDD--DATGITYTR-EGVEVDLSDKLWTDVVFNSKGI-GNRTNALRVWGRTNDALYLAFCRQNRN-LSYGGRPLDAGIPAGYHYLCADFLTG-AGL-TDLECA   191
BcLRaV-1  MPLLNRVSTSEKVVASQAGSGISYTL-GGAEYALKEDILSKIADLVP---RTGKNNLRLWARSRESMYLDVAFAQPD-LFKCERSLKANAPNGFAWASADFLPGVDHRLTDEMRA   204
CYLV      LHGYAIKTTSKQASE-PEGEFVNYTL-GETEYSFTEKDYLNIFDSIPRI--TGNNEPRVFCRSFATEYLDFFLKNSSTLPNNPRALSQGLPPGYHYLAADFLDACDKL-TLHEAA   178
MV-1      LVAFAIKTTSRQAVK-GDAEFVNYTL-SGHVSTATEKDITEFLNSLPQL-KDRKNKARVFCRSFAKEYIKTCRSHANSLPKQTRAIKLGIPDRYHYLQADFVTDCSEL-TDEEQA   168
TV-1      LYACAIHTTSKKAFR-PEGELTSYTL-SGKKHVVNTRDFLELLNSLPQL-SGKTNKIRVFCRSFSNQYLAVCREFGEKLPKQVRGTKLGIPTQYSYLQADFISDCAGL-SEVEQA   175
ReV-1     LFACAVRTTSKKAFS-TEGILAEYTL-SGKKYIVHARDLLNFINSLPQL-NARVNKIRVFCRSFANAYLSVCRAYSQQLPKLVRCTKLGIPAQYSYLQADFISDCSEL-TEHEQA   172
BYV       LYSCATIGTSNKVNVQPTSTFIKASFGGGKELYLTHGELNSFLGSQKLL-EGKPNKLRCFCRTFQKDYISLRKEYRGKLPPIARANRHGLPAEDHYLAADFISTSTEL-TDLQQS   170
BYSV      LYALATLSTSSKIDIEDKTPLVSAKI-DAVNVTITYEDIKNFVNSLTLL-KNYKNKLRVFARTFEEEYLRFVRQYKHILPNIARANKHGIPADYSYLAADFVQTSNLL-KEHEQA   184
GLRaV-2   LYALAARTTSPKVQRADSDVIFSNRF-GESNVVVTEGDLKKVLDGCAPL-TRFTNKLRTFGRTFTEAYVDFCIAYKHKLPQLNAAAELGIPAEDSYLAADFLGTCPKL-SELQQS   165
AV-1      LHAYNIRSTSPKVERDVDDILFSAVLSAGSAIVVLEGEVNAWLNNQSEL-KTHVNKARVLCRTLGDEYIAFLRENHSVLPPVPRANKHGISAAHSYMASDFYTSNKAL-SNEEQA   189
          :       :*                                            *  *          :         :           .    :  :**

FiVA      ALMIATKVALSRAAVTPE--AKIISLTQLGRV-------   236
FiVB      ALMVATKVALSKSAVAPE--ARIISLTQLGKTIG-----   248
FMMaV     MLLRSREVNLSRTSRDRS--GVLVSLLDLGN--------   233
RLMV      ILNLGRAEALKKEVGDTG--HSITSIKQLGRFST-----   198
RLRaV     IWRLARDMALTPKEGSDPV-QSITSLTQLGLKTQGGLYR   204
SCFaV     CYLQAQNHMLAEKAGIPAT-GTLTTIANLGYYKA-----   195
CTV       VYIQAKEQLLKKRG-ADD--VVVTNVRQLGKFNT----R   223
BcLRaV-1  AIVSCRKTLLKRSKEVNEIGHQLITLERLGVAS------   237
CYLV      AAVKAKDHALASKQ-VAD--QFVANVYEIGKH-------   207
MV-1      VLLHGRNHAVAPINSAAT--PIVTNLYELGGGKR----N   201
TV-1      VLIKGKDIALKSAAVVGT--TATTNLYELGTHSR----T   208
ReV-1     VLVRGRDRALNPVTGAGA--SSVTNLYELGSRSQ----Q   205
BYV       RLLLARENATHTEF-SSE--SPVTSLKQLGRGLGTG--R   204
BYSV      VLLEGRNAATASSG-TTR--ESAVNLKYLGGSSK-----   215
GLRaV-2   RKMFASMYALKTEGGVVN--TPVSNLRQLGRREV----M   198
AV-1      VHLHGSNHALKTEG-KEV--TEITSLFQLGRH-------   218
                                  .:  :*
```

Fig. S9. Alignment of hypothetical ORF9 protein sequences of FiVA and FiVB

Predicted transmembrane domains are marked in green

```
FiVA  MEVRLSRSEILISALLGLLCLVLLVTTLTYYVRARTLETRLRAVKNITAVDAAAWEEL    58
FiVB  MQIAISKSNCVILFVNLVIITALLFLLIRTCIRYSSLKTRVIAVRNSASVEAAGWEEL    58
      *:: :*:*: :*  :  ::  .**.  :   :*  :*:**: **:* ::*:**.****
```

Fig. S10. Alignment of hypothetical ORF10 protein sequences of FiVA and FiVB

Predicted transmembrane domains are marked in green

```
FiVA  MALSDNAIPFLTVLFLISLIIIVSIHPAFQKTSSSGLGAKDVLAHCQRNSYKQSASVYAGLSARDCKGPKIVKYRQD--    77
FiVB  MVC--DTIPFLIVLFLISLIIICSIHPSFQKQSSSGVGAKDLLQYFRREEYVKNASLYAKLSEIQYTRPKLGKTKRDGS    77
      *.   ::**** ********** ****:*** ****:****:* : :*:.* :.**:** **  : . **: * ::*
```

Fig. S11. Alignment of hypothetical ORF11 protein sequences of FiVA and FiVB

```
FiVA  M--SFDTNHLALSDVTVHGTVLARLRLLYIDSRLGFFKIVTSGSGEVRVHRIFEGMAILFDDGSFVNTRGDCMQRLDFELGSTIHCGVSLRKLTIETLRFLINREIDVYPIRYVT   113
FiVB  MDRNFLRRPLLLRNIVVQRLTRSIISFYFFDINNDIYLVHNRNDQHRDIPLCFEKIAILFFDGSYLDVSGSIFRKIYNDIVDVKMLNTLSNNINSNTLRILLSDMLVIVPLRYIT   115
      *  .*  . * * ::.*:  . : : : ::* . .:: : . .. .  :   ** :**** ***:::. *. ::::  :: ..   ..  .::. :***:*:.  : : *:**:*

FiVA  LTRETSVDLLSVVEGKGTVYTPVPFASYNLTLAFFTTSTKTAKYAHDVEDLKDTFSDMFEDGDVLTSFGLCDAR   187
FiVB  LTPETKESIRKVVLGTGYLYIPVLGSSNNLTLNIHTNRFWPSRYCSSVTILENEIRDVVKDGYVIDHISLCDTS   189
      ** **. .: .** *.* :* **  :* **** :.*.   .::*. .*  *:: : *:.:** *:  :.***:
```

Fig. S12. Alignment of p28/p26 protein (ORF12) sequences of FiVA, FiVB, and PeVB

Predicted signal peptides are marked in cyan

```
FiVA      MMSKTLRIRSPICLRMATFLQVLVYAMRVDSTPSYVIKMKGN--STEVGSSYGIPCYTCEE----VEYIAVYNVPHDARRLVLVNDKKDCNSATTTLIESTSRGNILYYDISLVD   109
FiVB      M-----------LLRMVMLLIILVYVTPVKTGECPYEVSFLN--GTKLSYVVGSTQFKCSE----LETIEIKNLQHEACRVSLVNIISSMNEGFSTLIESTAQSGTLYYDISLVD    98
PeVB-v1   MSL------TRICLR-KAFVQVLAHMV-MLSLLMLLRQGSGEIYGKVGNNPVHGGCFFWDDLGNNLGTVITSNKESAVRYHVSRNYSKTC-GAGNTLVEWTYKDGIVYYDISCVD   106
PeVB-v2   MSL------TRICLR-KIFALVLVHTV-MSSLPTLSKQGSGGTYGDSTAQGVGGTCYFWDALGNKIGTTIESDENESVRYYVSKNYSAKC-GAGSTLIEWTYNAGKTYYDISCVD   106
PeVB-v4   MLP------IKTCLR-KMFVRVSVHLV-ISFLLTLLRLEGGETFGDTYSNN-STGCYFWDVSGNKVGTTIISNTSEAIRYYVSRNFSPSC-GAGATLIEWTYKSGVTFYDISCVD   105
          *            **   :  : .:   :               .           :  .     :      :           *       .  **:* * . .  :**** **

FiVA      GVTCLPTELYEE-----TQLIYEFPRCDA-WSLCSDSVCASECSIHHDVHECEVEKPYTS-----HWEQKLRSSCLGENARVYTSAYDDSRGLLKTNVSYVKYVMRVITNQKEKD   213
FiVB      GLTCLPDGLVEK-----SRYIEKFPECNS-YILCGESLCKSQCSMTRDVHECELEKPYTV-----RWEEKLRSSCINENSRIYTSAYDDYRGLRISNSTSIFYTFRKRGTDRDLP   202
PeVB-v1   GFSCAVVAKCNDNDVFYSYLDSYNMYCRR-RNDCGE--CLSNCISEGKDDECCLNN-YTATVCNPQWSQWLWKLYNGSFKGIYTYAYDDDYGLHQCTNQVLFTTQISDKHDYSNP   217
PeVB-v2   GYSCAVSSLCNNDTVYFSHLDSSVDECNSKRNECGE--CVSGCISTNEDAECCRNS-YNSVTCKPQWSVWLHDTYASKFNGIYTYAYDDKAGLHICAGRVEFSTLPKFSLLYPGA   218
PeVB-v4   GFSCSVTAACDNKDVYYSHLDSKLLDCAS-VNLCGD--CISNCIRTNDDSECCIGV-YNAYSCRPTWSTLLKEKYKNYFNGVYTYAYDDAYGLHQCASSVIFKTITDERESGITD   216
          * :*      :.     :        *      *.:  * * *    .  **     *.       *.  * .   .    :** ****  **          .

FiVA      ---DMSGS---PRDNLRLYINLYQLWIHFFVYVKLLTCSA-----   247
FiVB      ---TNHASHVWQRTILRIIINLI-----IYIYLDIS---------   230
PeVB-v1   -LLISSSTKACINSVDRYLGVIF-----VAIVKEVFTKLISLLL-   255
PeVB-v2   TYTVSEAKRTCTNTVDRFIVVIA-----IGILKEVLTFGTDLLFK   258
PeVB-v4   YPVKSGESITCNDSVDRLIRLFV-----IGIVKELLSITLLGIFN   256
                 .        *    :      . :  .:
```

Fig. S13. Alignment of p23 protein (ORF13) sequences of FiVA, FiVB, and related viruses

```
FiVA     MRYFVNENTYATFFLQLDELKTRCGAIDSLKP-AYVSDLCVELNALISLYYVMLHESRNNYYSTEDHVNIKKHKDLKEAYKGLTEVLSILRNYYAIE-YGAYDVENAVRFIVSKY   113
FiVB     MRYYVNDNTYSTFFLQLDELNSRVGAIASLKP-TYVSDLCVQLNALVSLYYVLLQESRNNYYATEDHINIKKQKDLKDAYKGLQNILHILRSYYCIE-YGVYDAETAVRFLVVRY   113
RLMV     MRACFSIDDMINTISYVTICVAQIRRTDVTHSGDTLNPLIRALNDSIGTLTAMKLDANTTKLCGYYSEASNKLKHCATVEELIREWLFGCRRILITDVLGIRSIHDTFHFMINKF   115
CTV      MRAYFSVNDYISLLAKVSAVVERLCDPSVTLA--EVMDEINDFNSFLALVHSMKSDMNGDHQDGHHEMGEHKSRLLCNIEAKLRVLLDIIRRRFTRDKLLCTSATDVMGFFVMRY   113
TV-1     MKLYIQVKFYESYLKLITDLLEAINASNSSNE--KLVEWVTDFTDLCSRLQALKSDVNDAKREESANNLTRKANILKLAGDNLASIRDELRKRVFRD-IIDLSTEDTLRFFVARF   112
BYV      MKFFLKDGETSRALSRSESLLRRVKELGTNSQQSEISECVDEFNELASFNH-LLVTVEHREWMEQHPNQSSKLRVPSRIGEMLKEIRAFLKVRVVTP-MHKETASDTLNAFLEEY   113
GLRaV-2  MRVIVSPYEAEDILKKSTDILRDIDSGVLNTK-----ECIKVFSTITRDLHCAKASYQWGVDTGLYQRDCAEKRLIDTVESNIRLAQPLVRQKVAAH-FCKDEPKELVAFITRKY   109
         *:  ..       :                            :.             .             : .        :       :                .  :  .:

FiVA     ISLVGCTLNDVLKSNMVDITEYVMNEIRREIQIDFTSAAFPQSGVYRLKMKVRNVLKN----------ILGCTLNWDE---NGSLTISKKSAGVNAARVMTSQSERE   207
FiVB     MGYTGSSLSETLKENMVNVTEFVMNEIRREIQIDFTSAAFPQSGIFKLKMKVRNVLKN----------ILNIYLQENQ---DGSITVLKPSASENVARVTTSQSESG   207
RLMV     SELTNVPLSEVYEMKMKHVSTLVIREMIREHRLDISETCFPGHGILNLKMKTGAVKHLLDVETRPPTTLIGSTSS--------DMDIERADQLVNISWD--------   206
CTV      MSSSHTSFESVMRTELRLVVKAVLSDLSRAHKLDFSERAFAAYGILLQKGTVSTVCGQFDINLVSPSCV--------------------------------------   182
TV-1     MEVTSHTKDESLSYNVRDIVNTVLRRISSERSLDVSTNTFKQCDLLRMQKSLRSVWKH----------TLGHSEA--------ELFVEEK-----------------   184
BYV      CRITGLAREDALREKMRKVKSVVLFHHSELLKFEVTENMFSYTELLKLNLSLRVISSQ----------ILGMAI---------------------------------   177
GLRaV-2  VELTGVGIRDVVKMEMRSLTRAVLNKLSLEMAFYVSPRAWKNAEWLELKFSPVKIFRD----------LLLDVETLNELCAEDDVHVKKINEIEDENHDLELQEEC-   205
                  .    ::  :   *:        : .:   :        : .   :
```